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Universal Cutter and Reamer Grinder.

On this and the succeeding pages we give illustrations showing the construction of a new universal cutter and reamer grinder, which has recently been brought out by the Cincinnati Milling Machine Co., Cincinnati, Ohio.

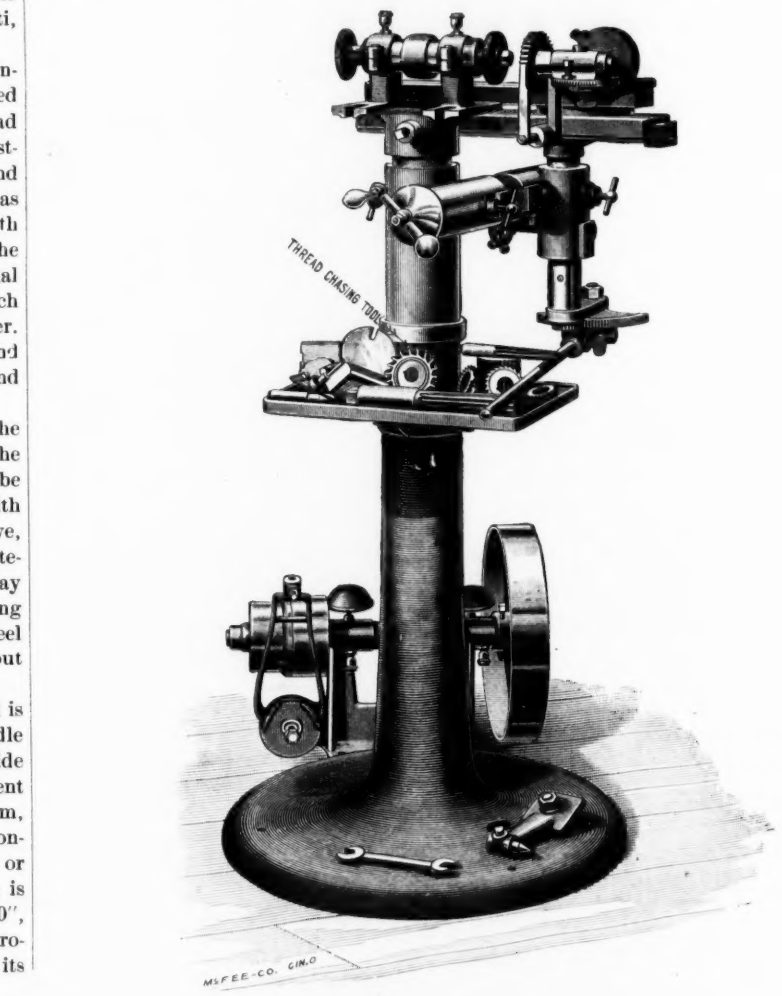
The machine consists essentially of a cylindrical column, to the top of which is fitted the head which carries the spindle, this head having a certain amount of vertical adjustment, so that an endless belt may be used, and kept at the proper tension. The spindle has but one speed, since all grinding is done with 3″ or 4″ wheels, though the curvature of the clearance surfaces may be made to equal what would ordinarily be obtained by much larger wheels, as will be explained hereafter. The spindle runs in hardened and ground steel bearings, protected by dust-caps, and carries a wheel at each end, as shown.

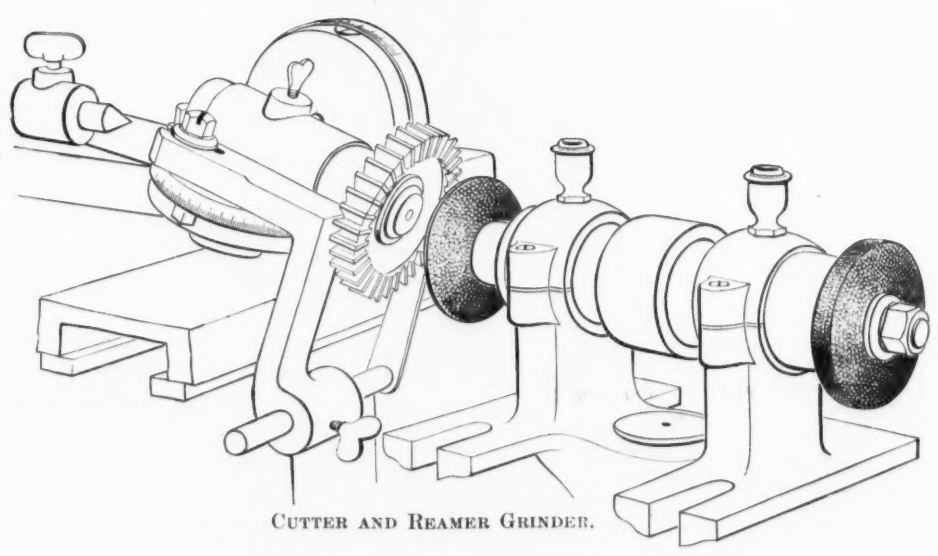
Below the head is a long sleeve fitted to the column, and to this sleeve is attached the mechanism by which the various tools to be ground are properly held and moved with reference to the grinding wheels. This sleeve, with attached parts, can be swung completely around the column, so that the work may be brought up to either of the two grinding wheels, or it may be changed from one wheel to the other as the grinding proceeds, without disturbing any adjustments.

The adjustment to and from the wheel is made by a screw moved by the crank handle shown; and the movement of the main slide is by means of a rack and pinion movement worked by the lever shown at the bottom, this lever being adjustable to suit the convenience of the operator. It is elevated or lowered by means of a rack and pinion; is 21″ long; has a horizontal movement of 10″, and takes between centers 15″. It is provided with adjustable dogs, by which its movement in either direction may be limited.

It swings to any angle for taper work, and carries a compound or swiveling head, which can be set at any desired angle, either in a horizontal or vertical plane. Graduations are provided by which all angular movements of the slide or swiveling head are indicated in degrees.

Those familiar with the grinding of milling cutters know the difficulty of setting the tooth guide for grinding angular or taper cutters, owing to the fact that the tooth being ground must be in a line exactly parallel with the slide. In this machine this difficulty is overcome by fixing the tooth-guide used on such work at the height of the center, the proper clearance being obtained by adjusting the height of the slide so that the center of the cutter is below the center of the grinding-wheel, the tooth-guide moving up and down with it in making the adjustment.





CUTTER AND REAMER GRINDER.

In all the detail cuts this fixed guide is shown, except one, where it is fastened to the head-stock, and remains stationary, as is necessary in grinding spiral mills. A cupped wheel is usually employed on one end of the spindle, which can be applied to side teeth as shown, thus getting any desired degree of clearance with a comparatively large wheel, and making the clearance surface practically straight. It is found that almost no trouble at all is experienced by heating and consequent drawing of the temper of teeth when grinding in this manner with such a wheel.

A square cutter, such as is shown in the outline cut on this page, can be ground on the outer edge in the manner shown by the general view, and afterwards swung around to the cup-wheel, and the side teeth ground without moving the cutters from the stud or the tooth-guide from position.

The detail cuts show the machine in various positions for different kinds of grinding, and are self-explanatory. Hand-rests are provided for turning off wheels, grinding gear cutters, etc.

It will be seen that the machine is adapted for a wide range of work, and bears evidence of intelligent painstaking in the designing.

The tallest chimney in America is no longer at Newark, N. J., where it has been for a year or two past, but is now at Fall River, Mass. This does not mean that the Newark chimney has been moved there, but one has been built at Fall River, which is taller by just five feet, being 340 feet high. It is 30 feet square at the base, and will furnish draught for the steam-making plants of four new factories. This is now claimed to be the tallest chimney in the world used for this purpose; the tallest in the Old World being used in chemical works. There is one at a cast-steel works in Bochum, Prussia, however, which is 347 feet high.

Ericsson and the "Monitor."

Prof. C. W. MacCord has, in the *North American Review* for October, a very interesting article, in which some of the inside history connected with the building of Ericsson's "Monitor" is, we believe, for the first time given to the public. Prof. MacCord was with Ericsson at the time as a draftsman, and is, of course, able to give many very interesting facts connected with the inside history of that event. A very high tribute is paid to Ericsson's ability as an engineer, as well as to his character as a man and citizen, and he is referred to as "the world's most illustrious engineer." Ericsson's indomitable energy and readiness in resources are well illustrated by the manner in which he remedied a difficulty which had arisen with the steering gear, and which the naval authorities proposed to overcome by putting in a new rudder, which would have required about a month's time. The vessel had at that time not been accepted by the Government, and still belonged absolutely to Ericsson. As was natural, he strongly resented this interference, and in three days had the defect remedied. The Government, it seems, never assumed the least risk in connection with the "Monitor," and, at the time of the battle of Hampton Roads, in which she defeated the Confederate ironclad, she did not belong to the United States Navy, but to Ericsson, and that she was there rather in spite of than with the co-operation of the naval authorities.

Prof. MacCord says: "It will always be recorded in the history of this country that the building of the 'Monitor' was sanctioned by the authorities at Washington only upon conditions the most arbitrary, and, in the circumstances, the most contemptible ever imposed by a great government upon a great designer. At a price barely sufficient to cover the cost of materials and labor, they would accept his battery, but not until it had proved impregnable under the guns of the enemy at the shortest range; in a most critical emergency, they would take all the profit if he would take all the risk. Twenty years before, these United States had reaped the fruits of his genius and his labor, when the building of the 'Princeton' had also marked a new era in naval construction. During all those years they had refused, as they have refused during all the longer years since, to pay him for his services, although, in the meantime, there had been days when the paltry sum would have been most acceptable. They are willing, it seems, that the memory of their meanness shall be everlasting, since they have allowed him to carry it with him to his eternal rest."

This is well calculated to bring the blush of shame to the cheek of every American citizen who has a particle of regard for national honor, but well illustrates the fact which has been before recognized, and that is, that an engineer who renders an important service to his country must expect far less recognition of it, as well as far less recompense than would be freely given in the case of a soldier or statesman who had accomplished something of equivalent value.

Referring to the criticism sometimes passed upon Ericsson that he made many mistakes, Prof. MacCord says that, in considering this, account must be taken of the immense amount of original work accomplished by him, which, of course, is obviously true; he who never undertakes to do anything not done before is re asonably sure not to make many mistakes.

"Mistakes he made, and he knew it; his projects were not always successful. In exploring new fields, errors are often found assuming the garb of truth so effectually that the imposition is not at once detected. In the development of new ideas perfection is seldom reached without repeated trials, and to say that the captain made mistakes is simply to affirm that he was human; but, when they are compared with the total results of his labors, the ratio is so small that no one has yet laid stress upon them who would not, in the caustic words of John Bourne, 'have been a much more distinguished engineer than he is if he had never done anything in his life except to contrive the mistakes of Ericsson.'"

Much insight is given into Ericsson's methods of work, and the article is well worth the reading by every one, and especially by engineers and mechanics.

Night-School for Drafting.

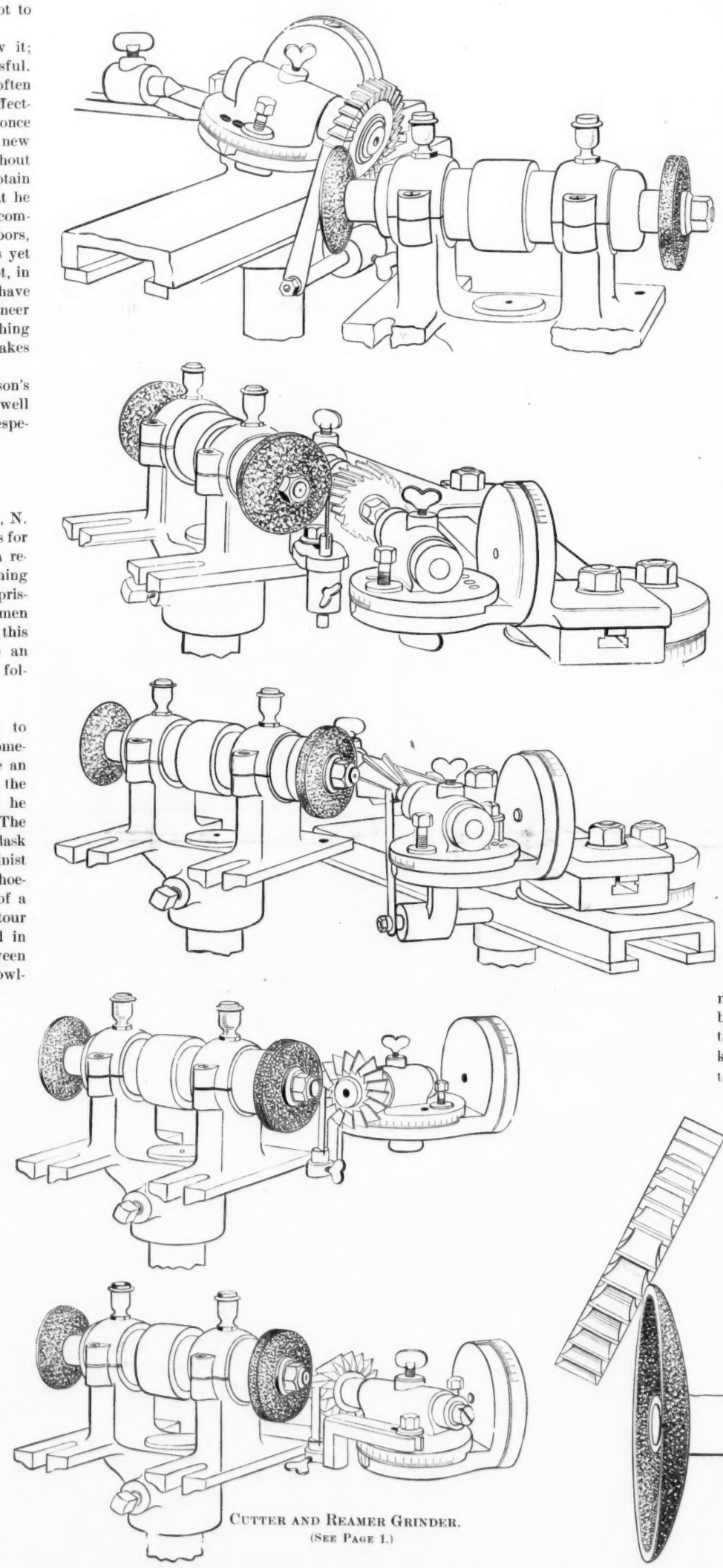
There is a movement at Syracuse, N. Y., towards establishing night-schools for teaching mechanical drawing. At a recent meeting looking towards establishing such a school, the attendance was surprisingly large, showing that the young men there are alive to their interests. At this meeting Prof. John E. Sweet made an address, from which we extract as follows:

PROF. SWEET'S ADDRESS.

Every man whose business it is to make something, or, in fact, to do something, will find a time that it will be an advantage to be able to mark out the shape or form of some object that he wishes to explain or talk about. The foundryman wishes to mark out a flask with a stick, in the sand, or the machinist a bolt with chalk, on the bench; the shoemaker wishes to illustrate the shape of a shoe, and the dentist delineate the contour of a tooth; in fact, all men engaged in construction or manufacture between these extremes, will find use for a knowledge of drawing. There is a kind of drawing (that is sketching or picture-making) that may be practiced independent of its commercial worth, but mechanical drawing, the kind of work your instructors hope to interest you in, is a thing of money value. It may not be educational, but you will find that there is a good deal to learn, and, as to calling up one's thinking powers, I know of nothing that surpasses it. In picture-making or sketching, the artist may, and probably does, to a certain extent, think of his drawings and his work.

In making drawings for the patent office, the drawing is the aim and end of the business, but in all other kinds of mechanical drawing the draftsman cannot and must not think of his drawing, but concentrate his thoughts on the object he wishes to represent. This is as true of mechanical drawing as of what is called high art. In mechanical drawing you not only have to think of the one object, but many, and, in machinery, think of it in motion. You can scarcely make the first mark without thought as to what it represents and the relation it bears to other things. This may not be mental discipline, such as one gets by the study of languages, of history or of nature, but if one imagines that he can learn to make drawings without thinking, that tools are designed without thought, or machines invented without study, he is liable to be mistaken. It is the scholar's business to know what has been done and who did it. It is the mechanic's business not only to know about things, but to do things. It's the engineer's business to know what has been done, and to do what has not been done.

It is the scholar's business to know history, it is the engineer's business to make history. The one looks backward, and the other forward. Nearly every engineer started first as a draftsman, or as a mechanic and then as a draftsman, and all mechanics know how to make drawings, or wish they did. If you have had no experience or training whatever, you will find it necessary to begin at the bottom, and your teachers will find it necessary to hold you at the preliminary work, compelling you to make drawings of such things as blocks or bolts, rather than spiral gearing or a locomotive.



CUTTER AND REAMER GRINDER.
(SEE PAGE 1.)

There is nothing too simple to form a good subject; your own drawing-board, or tee square, or the first geometrical figure, a block, cube, or cylinder; anything of which you can measure its general dimensions. It is much better to make drawings of things than to copy other drawings, unless the drawings are of something with which you are familiar, because, by making a drawing of an object you have before you, at the same time you are learning to draw, are learning the relation that exists between the object and the representation. It is the work of a lifetime to learn to determine how the unconstructed machine tool or building will look when completed from the drawing made in advance. I will venture to say that, aside from the architects, there is not one person in one hundred who has seen the plans of our City Hall, that is to be, who would recognize the building when completed should they see it somewhere else in its completed shape and know nothing of its construction. Architects and engineers themselves are sometimes surprised, and often disappointed, at the result of their work, and I have known cases where they failed to recognize it.

It is very desirable that you make your drawings look well, as it is desirable that everything one does be done well, but accuracy is of infinitely greater importance; not accuracy in the measurements of the lines, but accuracy in the facts expressed. A good sketch figured in dimensions that are correct, is of far more value than the finest drawings that contain mistakes. A single mistake in a drawing may cost hundreds of dollars in the work. I think it was John Stuart Mill who said he cared nothing about the spelling, nothing about the penmanship, for the important thing was to think right, and it is so with drawing. If you think right, and get your figures so that the information you wish to convey is correctly read by the one that is to understand it, the drawing fills its mission. Half the value of the knowledge of drawing is in its enabling one to read the work of others; in fact, this is many times the most valuable part of it. In many positions, as a foreman or pattern maker, for instance, it is the valuable part of it. They are called upon, often a score of times a day, to read the drawings of others, while they make no drawings at all; and this knowledge of the reading of drawings you can learn as you can learn to read books and letters, though you may make no great headway in writing them. As good a way to learn to read writing as any, is to learn to write, so as good a way to learn to read drawings as any, is to learn to make them. By making a drawing of anything you will learn more about it than in any other way, except it be something that you build. You may see a thing, mechanical or natural, and gain some knowledge of it; if you will take the trouble to write a description of it, you will find you know a great deal more, but if you make drawings of it, in all its details, you will then learn how little you knew before. This is educational, and knowledge gained in this way is just as valuable as knowledge gained in any other way, and with this advantage, that it is positive. What we read in books and are told is not always correct, and what troubles the student and technical scholar worst of all things when he gets into life's work, is that he knows so many things that are not true; as Josh Billings put the same thought, "One had better not know so much than so much that ain't so."

You need have no fear in not finding enough to learn in making drawings; the outside facts you will acquire, and the interest you take in things you make drawings of, that you had never taken an interest in before, will pay you for all your trouble.

As it is best to start with simple things in drawing, so it is best to begin with simple tools. A board, tee square and two triangles, a pair of compasses and pencil, will serve for a number of lessons. I have seen several succeed, starting with as simple a kit as this, and many fail with an expensive set of tools on their hands. Many a parent is ready, no doubt, to give his son a good set of

drawing instruments, but it is to be hoped that he will not do it until the son has made some progress with the simple ones I have indicated.

"The mathematician makes a rough diagram on his slate, paper or blackboard, and then, through a process of reasoning and a lot of figures, determines some fact he wishes to know, and, if right in his reasoning and accurate in his calculation, he will determine the fact with mathematical precision. The draftsman will take the same problem, make the diagram with the same accuracy he would the work, and measure the point he wishes to determine in a much shorter time. The mathematician will appear the more accurate of the two, but, as in every problem, in real work, there are one or more factors based upon unknown qualities, the absolute accuracy is only an imagination. As an example, suppose we wish to determine the size a cast-iron bar must be to sustain a given load under fixed conditions; it is an easy mathematical problem to figure the strain, but, as some cast-iron will bear twice the load of others, and as two bars out of the same heat will vary 20 per cent., it is easy to see that mathematical accuracy is useless. All the problems in arithmetic or algebra can be solved on the drawing-board, and with an accuracy equal to any emergency that can arise in actual workshop or engineering practice."

Rules for Spiral Springs.

BY W. H. BOOTH.

An English rule for the helical springs of safety valves is as follows:

Multiply the mean diameter of the helix in inches by the gross load on the valve in pounds, and divide by 3 for round wire, and by 4.29 for square wire. The cube root of the quotient will be the diameter in sixteenths of the wire or its side if square. Expressed in symbols this rule is as follows:

$$d = \sqrt[3]{\frac{D \times W}{3}};$$

where W is the area of the valve multiplied by the steam pressure.

Working out an example for a 3″ valve for 100 pounds pressure, we have $W = 100 \times$ area of valve (which is 7 inches) $= 700$. Assuming a coil of 4 inches mean diameter, we next have $700 \times 4 \div 3 = 933$; the cube root of which from a table or by logarithms is 9.77. The diameter for round wire is thus nearly $\frac{5}{8}$ of an inch. The following formula expresses the extension of one complete coil of the helix:

$$E = \frac{D^3 \times W}{d^4 \times c}$$ where c is a constant for wire of different sections, and equals 22 for round and 30 for square steel. Expressed as a rule. (The extension of one coil is as follows: Multiply the cube of the mean diameter of the spiral by the area of the valve, and by the steam pressure, and divide by the fourth power of the diameter of the wire (or of the side if square) and by 22 or 30 for round or square wire respectively.)

Where N is the number of coils, the total extension will be N times E.

If now it is desired that the normal pressure in the boiler shall not be exceeded more than three per cent., the number of coils must be so arranged that the lift of the valve, when blowing, shall not compress the spring to a greater than three per cent. excess over its normal stress.

An ordinary 3″ valve lifts perhaps $\frac{1}{16}$th of an inch, and therefore this amount must not exceed $\frac{8}{1000}$ths of $E \times N$. We require therefore to find E by the formula given:

$$E = \frac{D^3 \ W}{22 d^4} = \frac{64 \times 700}{22 \times 9{,}115} = .223$$ of an inch per coil.

Therefore the total extension will be $.223 \times N$, and as $\frac{1}{16}$th of an inch is to be $\frac{8}{1000}$ths of $E \times N$ we have $\frac{8}{1000}$ of $.223\,N = \frac{1}{16}$″.

Therefore $.669\ N = 8.5$ or $N = 12.7$, or nearly 13 complete coils.

With a coiled spring wound fairly close, a free spring would require for each coil a length of $\frac{9}{64}$″ for the wire thickness, and of fully $\frac{14}{64}$ths to allow for compression or a total say $\frac{23}{64}$ths. Allowing for a fair amount of clearance, we should allow a total of 1 inch for each coil or a length of 13 inches for the free spring. When compressed the length would be $13 \times .223 = 3$ inches nearly shorter, and such a spring would allow the valve to rise $\frac{1}{16}$th of an inch under an increased pressure of 3 pounds. The values given do not differ much from those given by Molesworth, but are considered more suitable for valve springs, the rules in Molesworth being for car and similar springs.

The larger the mean diameter of the coil is chosen, the larger will be the proper diameter of the wire. Considerable latitude is thus allowed in the proportion of the coil, whose resistance is simply to be proportioned to the total load on the valve. The number of coils required depends entirely upon the lift demanded of the valve, and the allowable rise of pressure beyond the normal. Large lifts demand a large number of coils, and when specially large lifts are demanded, use is made of the reaction of the escaping steam to effect such lift, and there are spring-loaded valves, which will relieve a boiler of all the steam it can generate without appreciable difference in gauge pressure between the valve closed and fully open.

If by using the constants given, and which were determined from a certain quality of steel, it is found that a spring results of too stiff or too weak a nature, then a change may be made in the constants in order to make allowance for such difference in quality.

It is quite common to see safety valve springs designed without any reference to the increment of pressure beyond the supposed nominal blowing-off pressure. Such fault always seems to be in one direction, that of undue shortness of the spring, that is, lack of a sufficient number of coils to give the deflection necessary to allow a sufficient valve opening with a 2 to 3 per cent. rise of pressure only.

This looks a little like loose methods in the line of inspection:

A Board of Trade Report has been published on the explosion due to collapse of furnace tubes in the boiler of the "Queen of the Isles," of Liverpool. The collapse was due to heavy incrustation, and to failure on the part of the men in charge to draw off salt water. Neither the first nor second engineer in charge held certificates.—*London Engineer.*

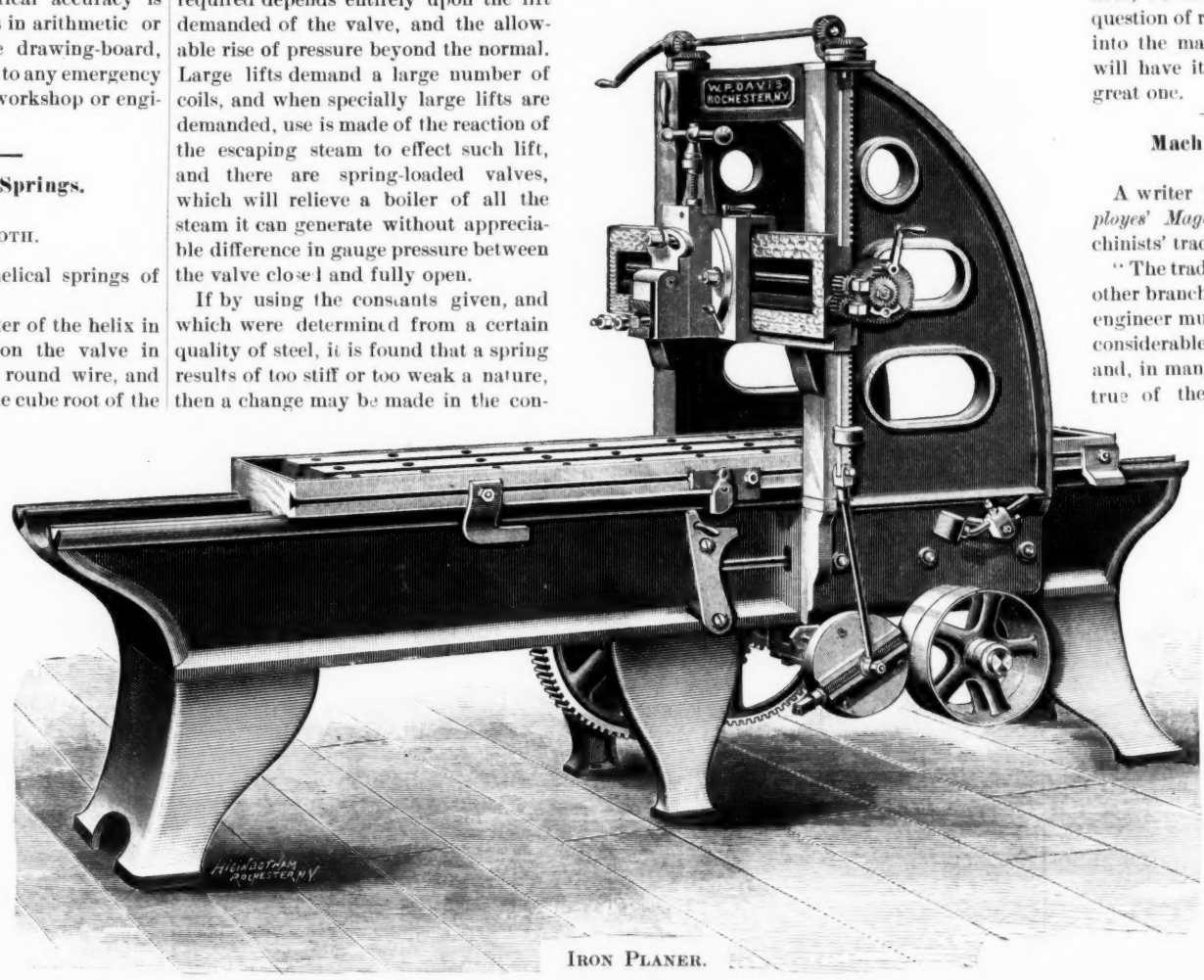
Teacher—If a man has two hundred pounds of ice in his wagon and one-fourth of it is lost by melting, how many pounds do his customers pay for?

Boy (whose father is in the business)—Three thousand pounds.—*Life.*

Iron Planer.

An iron planer has recently been brought out by W. P. Davis, of Rochester, N. Y., which is illustrated by the accompanying engraving made from the 24″x24″ by 6′ size.

The machine has all the regular standard features of planing machines, the design and proportion being made so plain by the engraving as to make a detailed description unnecessary, except to say that two belts are brought down from the countershaft, one on each side of the machine.



IRON PLANER.

Decimal Measurements.

In relation to the discussion of decimal systems of measurements, General M. C. Meigs favors us with a copy of a study of the growth of population in the United States, of which he is the author. It contains much that is interesting, but its connection with the subject under discussion is sufficiently brought out by the following statements made in an accompanying letter from Gen. Meigs. He says: "The law therein developed, from the history of 250 years, promises in its effects to have weight in determining the answer to the question of changing all American tools and machines to adapt them to a false and inconvenient standard. The metric system is erroneous. The decimal system we have on every foot rule or engineers' scale. In 1700, France had a population of 19,600,000. The United States had in 1700 less than 1,000,000 and now 67,240,000. France's highest population was in 1856, when she had 38,000,000. In 1940 we shall probably number 284,000,000. Whether France will then be stronger or weaker than now, no one can predict with certainty. But it does not appear probable that she will be a more efficient propagator of an erroneous standard and an inconvenient division than now."

We are not quite sure whether Gen. Meigs understood us as advocating the adoption of the metric system in this country, but we think that nothing we have said upon the subject will bear that interpretation. We think we have a reasonably clear idea of the difficulties which would be in the way of such a change, but the point we wish to make is that these practical difficulties which stand in the way constitute the strong argument against it, and should be emphasized, rather than the inherent faults of the system itself. We only mentioned the metric system because it is a decimal system, and we were trying to point out that, regardless of disadvantages which decimal systems may possess, they also possess some advantages. We do not believe in forcing the adoption of any system of measurements, but we do not like to see our people fail to take advantage of a good thing to the extent that might be advantageous for them on account of prejudice or an erroneous idea of what is involved. We believe that a more extended use of decimal divisions of the inch could be advantageously introduced, and we also believe that the natural tendency is and will be in that direction. This tendency will probably continue until decimal divisions are used to that extent which is most advantageous, but the rapidity of the movement will be much affected one way or the other by new inventions and consequent changes in the methods of doing work, as it has been undoubtedly much accelerated by the introduction of micrometer calipers.

The question of a uniform standard between all civilized nations may in the future, when international trade and commerce increases, become more important than now, but when it comes to be adopted, if it ever does, we think that much besides the question of relative population will enter into the matter, though that of course will have its influence, and perhaps a great one.

Machinists as Engineers.

A writer in the *Union Pacific Employes' Magazine*, speaking of the machinists' trade, says:

"The trade is a stepping-stone to man's other branches of industry. The marine engineer must be a machinist, or have considerable knowledge of the trade, and, in many parts of the world, this is true of the locomotive engineer, and there is no good argument to show why it should not be the universal rule. There would be less monkeying with the running and valve gears of a locomotive with a coal-pick if it was, and there would be considerable more intelligence displayed in the average roundhouse report book."

There is more truth in this than most engineers will be willing to admit, principally because very few of them are machinists. Of course, it is not true that no one can become a good locomotive engineer without first being a machinist, for there are many excellent engineers who know practically nothing of the machinists' trade. In the early days of railroading the engineers were mostly machinists, because no one else knew enough about the machines to manage them. Of course, it was perfectly natural for the firemen employed upon them to acquire an ambition to run them, and it was also quite natural for them to conclude after a while that the only man who could really be called a good engineer was one who had never worked in a machine shop. It seemed to strengthen their own position; and from this the belief has come to be quite general among engineers and firemen, not merely that shop training does not qualify a man for running a locomotive, but that it actually disqualifies him, and makes it impossible for him to ever become a good engineer, no matter how well adapted by nature to the business.

We have no doubt there are many men employed in subordinate positions in the engineers' department of large steamships, who could easily persuade themselves to believe that no one who had ever been a machinist could possibly be as good an engineer as one who had not been. But large marine engines remain in charge of men who are machinists, no matter what other qualifications they may possess.

Practical Details of Blacksmithing.

By B. F. Spalding.

STORING AND HANDLING STOCK—RACKS FOR BAR IRON.

Much of the facility with which work can be performed depends upon the manner in which the stock is disposed, in respect to making it convenient of access. It is the same whether the material is of great bulk, like the huge blocks of granite or marble in the stone yards, the logs in a saw-mill, the pig-iron for a foundry, or the stock for manufactures which employ raw material of much smaller dimensions. In the grosser quantities the advantage is more noticeable, but in the lesser it is not the less real.

The matter of storing stock in the most convenient manner is one which, in making arrangements for building a shop, is likely to fail of being duly considered, because other things, which may be, in fact, of less importance, force themselves more prominently into notice. Then, after the shop is built and operations have commenced, this matter is let run to take care of itself, because it has not entered regularly into the designed system. The golden rule of order —"A place for everything and everything in its place"—is broken in its provisory clause. There is no appointed place for each and every particular kind of stock, and some of it gets laid down promiscuously in whatever available space appears. In this way it may happen that one kind of stock, which is not wanted for immediate use, will be covered up by another kind which is likely to be worked up at once, and that this circumstance is forgotten. The programme may be changed before enough of the last stock is worked off to leave the first in view, and that which is covered up may be wanted and cannot be found. Circumstances of this nature need not occur if a rule is adopted to this effect: "Never cover one kind of stock with another." It may happen, also, in this indiscriminate method of taking care of stock, that a valuable lot may be stowed away where no one can find it even when it is wanted, so it is evident that no other rule can be as good as that which requires that a certain place shall be assigned to every particular variety, and, if proper care is exercised, some plan may be carried out which will secure the benefit of this policy. Tending to this end, it may be of interest, and, perhaps, suggestive of improvements, to consider the different modes of disposing of stock.

Shops running on special work—doing a large business on a few kinds of stock—may have it so systemized that the stock may be brought to the door on cars, and taken from them to the place where it is to be at once operated upon, but in the vast majority of cases this is not practicable, because the demand for any particular size does not happen to be so great as to cause the regular consumption of such quantities, and it is, besides, not good policy to become dependent upon the casualties of railroading for the necessary supply. These are held responsible for many delays which could be well avoided if allowances were made for their occurrence in ordering the stock and fixing the dates of shipment.

When stock of assured quality is on the premises, one very frequent cause of delays is guarded against, and, although its storage for a time may be at the expense of one more handling, the advantage is generally great enough to compensate for it.

In some establishments where the business is carried on with conspicuous rush and bustle, the stock, in all sizes, lengths and qualities, is thrown from the cars or drays in a mixed pile, the great object being to unload it on the premises, assuming that, from the tangled, tied and twisted mass it can be extricated, then separated and assorted, moved and racked, or piled, in convenient shape afterward, and that this is the quickest and best way to make the change from transit to stowage. Particular occasion may require this kind of treatment, but generally the more orderly course of keeping each kind by itself until it reaches its destination is much to be preferred.

"What is the use of all the pains which is taken in arranging and shipping stock carefully assorted in the cars?" is the query which occurs to the observer, as, in a crowded city, he cautiously peers down a hatchway, and sees common and refined iron with cheap and expensive steel, all kinds cut to special, yet hardly distinguishable, variations of length, thrown down there together in a promiscuous pile. He may see half a dozen men digging away at the lowerend of the mass, trying to get out bits of such stock as they require for immediate use, and, as the establishment makes great quantities of work, he knows that this is the general condition of affairs. In the lull of dumping in the stock, the daring roustabouts may pull it out bar by bar and stand it up against and along the walls of the underground storeroom, but in busy times it never gets cleaned up, unless it may happen, as it sometimes does, that the stock most needed is buried beneath the whole lot, when a force employed all night may be able to rescue it. It certainly appears as if this mode of proceeding could be improved upon, even under the untoward circumstance of being exceedingly cramped for room.

It has become the common usage in ordering stock to specify the lengths in which it shall be delivered. These are such as are required to make the pieces for which they

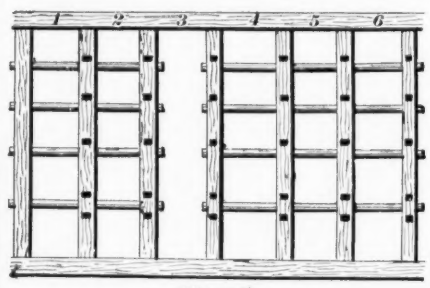


Fig. 1.

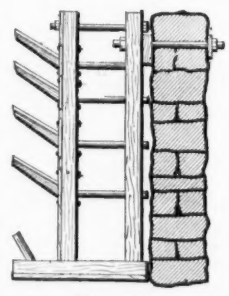


Fig. 2.

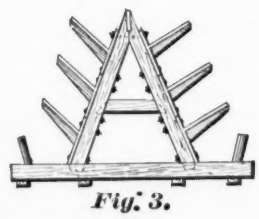


Fig. 3.

are intended. This practice saves the fag ends of bars from appearing as scrap, and is, therefore, of some value when the pieces used are of lengths exceeding one foot, and of size larger than one inch square in cross-section. Exceptional cases may find economy even in closer cutting, but, on account of the constant tendency to change, even on what get the appellation of "standard" machines, close cutting—especially towards the close of the business year—is often only cutting for the scrap-heap.

This practice of cutting stock to lengths, ready to go to the forges when it is received, makes it advisable to give extra space around the forges for the purpose of piling it up there when it is first unloaded, for storage room there is worth the cost of one hauling, more than it is in any other place. The idea that, in getting workmen "close enough together to touch elbows," there will be a gain of production through emulation, is not based on good fundamental principles. Blacksmiths certainly should be so far separated that one will not be scorched by another's fire, nor interfered with by his work.

There is much to be considered in arranging the machines in the blacksmith shop so that, if there is a regular run of work, it can go on in regular progression from forge to forge without intermediate handling, the second man taking it from where the first lays it. It is not that the moving it is so expensive, but that it is often inconvenient bringing a man and truck in the way to obstruct the work. This is the restriction upon placing the forges too remote from each other. Some systems of manipulation require that the drop, trip-hammer and punch press shall stand conveniently close together so that work may go at the same heat from one to another, and so on through all. These may be worked by one or more men, as the system requires, the rule being to work as many as can be kept continuously employed, so that one may not wait upon another. Other plans, perhaps, pass the work through a number of drops, taking impressions from each at the same or a subsequent heat. Or it may be from the heading machine to the drop and bending machine, or other combinations and tools, such, for instance, as are used in axe factories. In such cases the tools may be short-circuited, or brought nigh to each other, and room for storing the stock may be left as convenient as may be to the forge, which takes the first heat.

It is especially desirable that there shall be ample space left around the punch presses and shears, for these, generally, have something to do with a large part of the work. Whatever efforts may be made to avoid handling the work more than is actually necessary, it frequently happens that it must stop somewhere after it is sheared or punched before it goes to the next place to be operated on, and if it cannot be moved and piled up at the forge at once, but can be piled up near the shears, it will save handling to do this, rather than to move it away to some intermediate station.

Movable stands, capable of holding half a ton or more of iron, are very convenient when there is good flooring. They are especially useful at the presses. The work can be sheared and laid on one of these trucks as it is cut, and moved without further handling to the punch press, and taken direct from the truck, punched and laid upon another, ready to be moved again. When the floors are very level, wheels as small as 4″ may be used, but a small obstruction which, to a 4″ wheel heavily loaded, would be insurmountable, would be run over without difficulty by a wheel three times as large. The wheels are best made of cast or malleable iron. More than two to a stand is needless. These form two supports forward of the center. A third is a strong leg at the back end. It will not require much strength or skill to move this stand wherever a truck with casters can be run.

There are two general methods of storing bar iron; one is to stand it on end leaning against some support, and the other is to lay it down horizontally. The one great advantage of the first is that, thus stored, it occupies, in small amounts, very little ground space, and a greater variety can thus be kept conveniently in a small compass than in any way, but it is neither handy to put up or take down, especially if the bars are long. Accidents are liable to occur in either operation, or may result from carelessness in standing it up. There is not the full amount gained in ground space that appears to be at first sight, for as much room must be left for an allowance in which to take it down, as it would occupy lying on the floor. As this space, however, may be common for use in placing stock against opposite walls, or as, in case the bars are arranged around the walls of the working-room, the space may be used for other purposes, except while the stock is being handled, there is, for limited quantities, a measurable amount of economy of space in thus disposing of the stock. It is of great value where all the ground space available is much needed for working room.

Wherever there is room to do so, the best way for storing iron is on racks where it can lie horizontally. They are made in different forms, either to take the iron in at the ends while they are closed at the sides, or they are open on one side as well as at the ends.

When the iron is unbundled, or in free bars, those racks which are only open on the ends are not inconvenient to use, and nothing better can be desired. The end view of a single rack of this kind resembles a ladder; the stock is laid on the rounds. To make a series of racks of this kind for stock exceeding eight feet in length, three rows of posts may be placed in position, the distance between the rows being three and a half feet, and that between the posts being governed by the amounts usually kept in stock. Holes are bored in these posts, and bars of round iron of suitable size are inserted in them to hold up the weight which they are intended to bear. It is in some cases an advantage to connect these racks together in groups of two or more, leaving open places between the groups, like stalls, for storing larger quantities between the posts, as, for instance, the round irons which may come by the carload of the same size, to be used for bolts, and which can be carried into these stalls in the bundle, and unbundled in them. Large sizes, which are too heavy to shove endwise into the racks, may be stored in the stalls, or with a little trouble they can be run on rolls into the lower racks. It is a good plan to fasten the cross-bars of round iron, on which the stock is to rest, with nuts, on each end, to prevent the racks from spreading open. On some accounts it is an advantage to have each tier of uniform height of opening, the lower ones being, say, twenty inches high, and those above grading less as the height from the floor increases.

A front view of this style of rack is shown in Fig. 1. Each stall is numbered at the top, and each rack is furnished at the side with a label giving the size and whatever other information is necessary in regard to the stock it contains. The 3 stall in the cut is left open for bundled or large iron. As great weights of stock can be placed upon these racks, it is necessary to secure for them good solid foundations. This style of rack is very economical of ground space.

Wall racks are very well made by fastening upright timbers to the walls by bolting them firmly to the wall at the top, letting the lower end rest on a good foundation. To these upright timbers arms are to be attached, on which the stock is to be placed. When the wall is long enough to admit of access to the end, this rack may be combined with the ladder rack in the manner of which a side view is shown in Fig. 2.

By hanging a substantial foot-board on the front side of the wall rack, at a height of seven feet from the floor, the arms can be used as high as fourteen feet, and, by leaving off the arms below the foot-board, the whole floor space can be saved for other purposes. Two men can lay on or take off stock from this upper rack nearly as well as one could if it were on the ground. It is more particularly useful for storing special stock for occasional use, which it is not desirable to have so convenient of access that it will be used for other purposes besides those for which it is peculiarly adapted. From the fact that extraordinary display must be made in getting it down, it will not be likely to be molested except by those who have it to work into its designed forms.

Where there is ample floor space the "A" rack is to be preferred to all others. It is of the form shown in Fig. 3. The legs of the drawing stand open, forming an angle of 40°. The arms on the left-hand side are at an angle of 50° with the perpendicular; those on the right about 60°. If the legs span an angle of 60°, the arms can stand at right angles with them, in which case they would be on the same slant as those shown on the right-hand side of the figure. As the rack is made less in width, it of course gives less storage between the legs, but it takes up some less space, and the top racks are somewhat more accessible, as the iron on the lower racks does not protrude so much beyond that on those above. The arms may be 18″ long from the plate, 3″ wide, and 1″ thick next the plate, and 2″ wide at the end, supported by a rib beneath 2″ wide at the plate and 1″ at the head, and having a uniform thickness of ¾″. The plate, 16″ long, 3″ wide, 1″ thick. If the arm starts out 5″ from the top of the plate, the lower ends of the plate may rest on the sills, and give a space 8″ deep at the back side of the lower rack, of which the sills are the bottom. The pieces of 1½″ round iron, inserted in holes in the sills, keep the iron on the lower rack

from straggling. The legs may be of 3″x5″ or of 4″ square; the sills of 4″x6″. The figure shows a part or section of a frame. Two or more of these are put together to form the rack. They are connected at the top by the ridge-board, and at the bottom by stringers, which may be 2″x4″, and of whatever length is required to join the two ends of the frame. If the rack is to stand on a floor the stringers may be dispensed with, and the frame bound together by flooring the lower middle space, or by footboards across the sills outside the iron pins. This rack, made with three sections, will hold 16 tons of $\frac{5}{8}$ round iron, 12 feet long, besides whatever amount may be placed between the legs. Its full capacity is about 20 tons. The oldest one I have seen stood in Indianapolis in 1883, with a lot of rubbish in an old disused shed, which looked as though it might have been, in its palmy days, the annex to a manufactory, all other vestiges of which had disappeared; but, though the moss of a quarter of a century was on it, it was as new to me as though it had just been made.

Practical Drawing.

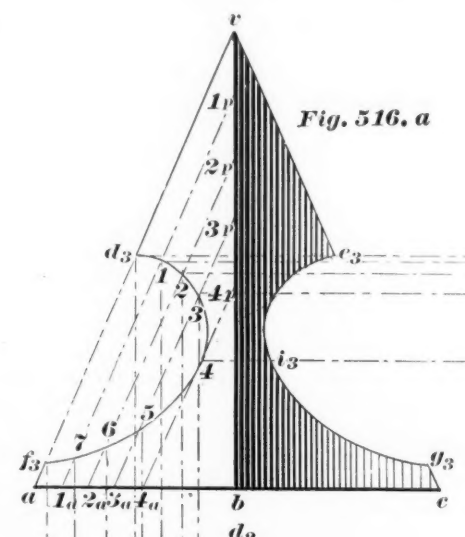
BY J. G. A. MEYER.

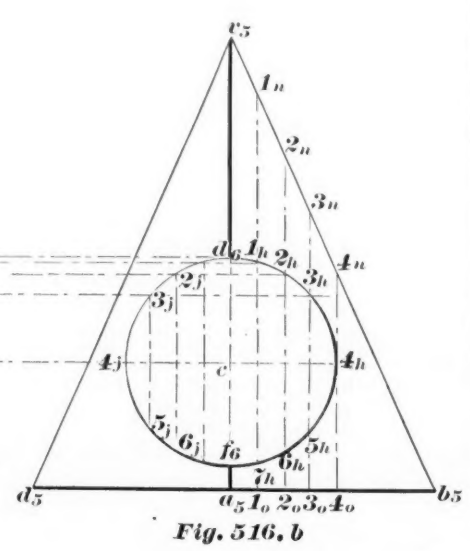
EIGHTY-NINTH PAPER.

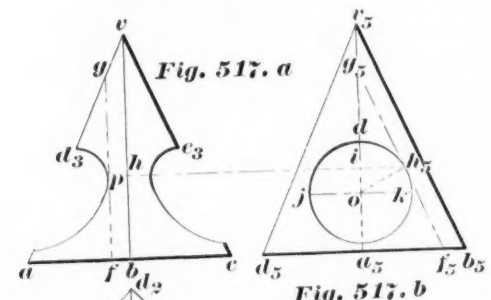
639. If now we remove the cylinder shown in Figs. 515, 515*a* (last paper), we then obtain views of the pyramid as shown in Figs. 516, 516*a*. Here we have added another view as shown in Fig. 516*b*, which represents the pyramid with the axis of the opening, standing perpendicular to the vertical plane of projection. Such a complete view (Fig. 516*b*) is not required for finding the intersections of the cylinder and pyramid; indeed, in our last paper we have seen that the end view of the cylinder, in fact, only the semi-circle $d_6\, j\, f_6$ was all that we needed for finding the intersections. Our purpose in giving here such a complete view as shown in Fig. 516*b* is to enable us to point out the principles upon which the construction is based. A clear conception of these principles will give the student confidence in his work, and may often prevent him from falling into error.

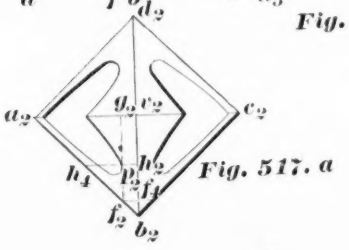
We have already explained the method for finding the points 1, 2, 3, etc., in Fig. 516*a*, we have also explained the method for finding the lines 1*a* 1*p*, 2*a* 2*p*, etc., and further explanations of these methods are not needed.

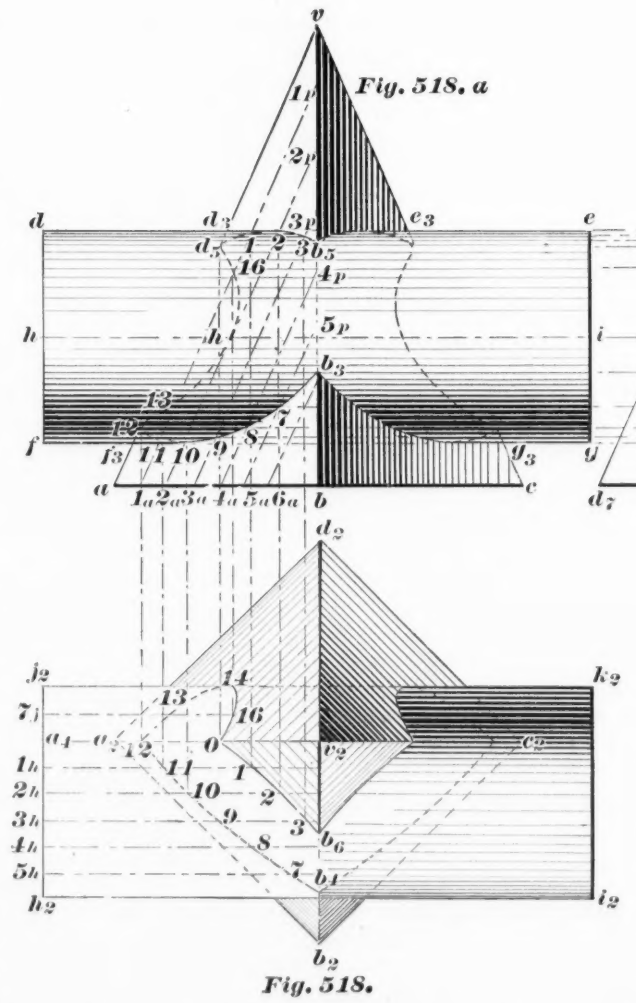
In examining the construction closely, we may be led to ask, what do the lines 1*a* 1*p*, 2*a* 2*p*, etc., represent? We may answer this question at once by saying that these lines represent the intersections of auxiliary cutting planes with the lateral face *v a b* of the pyramid. The horizontal projections of these intersections are represented by the lines 1*b* 1*m*, 2*b* 2*m*, etc., and furthermore, these lines indicate that when the pyramid occupies the position as shown in Figs. 516 and 516*a*, the auxiliary cutting planes are parallel to the vertical plane of projection. If we now turn the pyramid with the cutting planes one-quarter of a revolution around the axis of the pyramid, we then bring the cutting planes perpendicular to the vertical plane of projection, and obtain a view as shown in Fig. 516*b*, in which the lines 1*n* 1*o*, 2*n* 2*o*, etc., again represent the intersections of the cutting planes with the lateral face $v_5\, a_5\, b_5$ of the pyramid. Here then we see the reason for dividing one-half the diameter 4*j* 4*h* (Fig. 516*b*), and the line v_2 4*m* (Fig. 516), which also represents one-half the diameter of the cylinder, into the same number of equal parts; for it must be evident that the distance from each cutting plane to the axis of the pyramid must be the same in both views (Figs. 516 and 516*b*). Now let us confine our attention simply to the line 4*o* 4*n* in Fig. 516*b*, the line 4*a* 4*p* in Fig. 516*a*, and the line 4*b* 4*m* in Fig. 516. These lines we know represent the intersection of one and the same auxiliary cutting plane with lateral face ($v\, a\, b$, $v_2\, a_2\, b_2$) of the pyramid. But now notice that the line 4*o* 4*n* is drawn through the extremity 4*h* of the diameter 4*j* 4*h*, therefore the cutting plane must be tangent to the cylindrical surface, and must touch this cylindrical surface in one of its elements, that is to say, in one straight line, and in Fig. 516*a* this line of contact must evidently be a part of the horizontal line drawn through the point 4*h*. But the line 4*a* 4*p* is the intersection of the same cutting plane with the face *v a b*, therefore the line 4*a* 4*p*, and the horizontal through 4*h* must lie in the same cutting plane, and the point 4 (Fig. 516*a*) in which these lines meet, must be a point in the curve of intersection. And lastly, the point 4, in Fig. 516, in which the vertical line through the point 4 in Fig. 516*a* cuts the line 4*b* 4*m*, must be the horizontal projection of the same point in the curve of intersection.

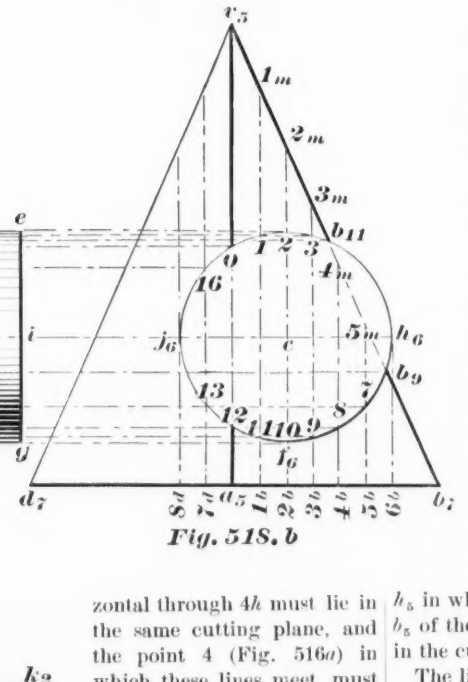












641. The principles upon which this construction is based are as follows:

The line $g_5\, f_5$ (Fig. 517*b*) represents the intersection of an auxiliary cutting plane, parallel to the axis of the cylinder with the face of the pyramid; and since this cutting plane is parallel to the edge $v_5\, b_5$, and since it is also tangent to the cylindrical surface, it contains an element of the cylindrical surface, which is nearest to the edge $v_5\, b_5$, and point h_5 in which this element pierces the face $v_5\, a_5\, b_5$ of the pyramid must be the nearest point in the curve of intersection to the edge $v_5\, b_5$.

The line $g\, f$ in Fig. 517*a* also represents the intersection of the same cutting plane, and the lateral face *v a b* of the pyramid. According to Art. 608, and Figs. 497, 497*a*, the line $g\, f$ must be parallel to $v\, b$, as we have shown it, because the cutting plane is parallel to the edge $v\, b$. Furthermore the line $g\, f$ must contain the point nearest to the edge $v\, b$; this same point must also lie in the horizontal line through h_5, therefore the point p in which the horizontal through h_5 cuts the line $g\, f$ must be the point sought.

PROBLEM 106.

642. *Intersection of pyramid with cylinder.*

Let Figs. 518*a* and 518 represent the horizontal and vertical projection of a pyramid and cylinder, the latter being passed through the former. The axis of the pyramid is perpendicular to the horizontal plane of projection, the edges ($v\, a$, $v_2\, a_2$) and ($v\, c$, $v_2\, c_2$) are parallel to the vertical plane of projection; under these conditions the axis and these edges will

lie in a plane which is perpendicular to the horizontal, and parallel to the vertical plane of projection. The axis of the cylinder is parallel to both planes of projections, and at a given distance from the axis of the pyramid. It is required to find the intersections of the cylindrical surface with the lateral faces of the pyramid.

To find these intersections we need another elevation such as is shown in Fig. 518*b*. We will assume that this elevation has been drawn. It may be well to caution the student that the elevation in Fig. 518*b* is worse than useless, unless the base lines $a\ c$ (Fig. 518*a*) and $d_7\ b_7$ (Fig. 518*b*) lie in one and the same horizontal line, and the cylinder drawn at the correct distance above the base. The distance between the two views, Figs. 518*a* and 518*b*, is a matter of convenience.

Divide the diameter $j_6\ h_6$ (Fig. 518*b*) into any number of equal parts, say eight. In this case one of the points of division falls on the line $v_5\ a_5$; this was done for the sake of simplicity, and not because it should be so in all cases. Through the points of division draw vertical lines cutting the circumference of the circle in the points 16, 0, 1, 2, etc., and 13, 12, 11, etc.

Fig. 518. Divide the diameter $j_2\ h_2$ into eight equal parts, and through the points of divisions $7j$, $1h$, $2h$, etc., draw horizontal lines. Through the points in which these horizontal lines cut the line $a_2\ b_2$ draw vertical lines cutting $a\ b$ (Fig. 518*a*) in the points $1a$, $2a$, $3a$, etc.; these vertical lines have not been shown, because they may lead to confusion. Through the points $1a$, $2a$, etc., draw the lines $1a\ 1p$, $2a\ 2p$, etc., parallel to $v\ a$.

Through the points b_{11} and b_9 in which $v_5\ b_7$ cuts the circumference of the circle (Fig. 518*b*) draw horizontal lines cutting $v\ b$ (Fig. 518*a*) in the points b_5 and b_3, which will be points in the curve of intersection. If now the student is familiar with the principles pointed out in Art. 639 he will not have any difficulty in finding other points in the curves of intersection; we shall explain the manner of finding only a few of them. The circle $j_6\ b_{11}\ h_6$, in Fig. 518*b*, not only represents the end of the cylinder, but the circumference of this circle is also the projection of the curve of intersection in this particular view, hence we may say that the points 1, 2, 3, etc., are points in this curve, and all that remains for us to do is to find the position of these points in Figs. 518*a* and 518. Let us consider, for instance, the points 3 and 9 in Fig. 518*b*; it is required to find the position of these points in Figs. 518*a* and 518. The line $3b\ 3m$, which contains these points, is the intersection of an auxiliary cutting plane with the face $v_5\ a_5\ b_7$ of the pyramid; in Fig. 518*a* this same intersection is represented by the line $3a\ 3p$, hence the points 3 and 9 must lie in this line, therefore, draw through the points 3 and 9 (Fig. 518*b*) horizontal lines, cutting $3a\ 3p$ in Fig. 518*a* in the points 3 and 9, which will be another two points in the curve of intersection. In Fig. 518 the horizontal line through the point $3h$ represents the same auxiliary cutting plane, therefore the points 3 and 9 must lie in this line, and furthermore they must lie in the vertical lines drawn through their vertical projections; therefore through the point 3 and 9 (Fig. 518*a*) draw vertical lines cutting the horizontal through $3h$ (Fig. 518) in the points 3 and 9, which will be two points in horizontal projection of the curve. In a similar manner we find the points 1, 2, 11, 10. Now let us consider the points o and 12. In Fig. 518*b* these points lie on the edge $v_5\ a_5$, and therefore must lie on the same edge in Fig. 518*a*; hence through the points o and 12 (Fig. 518*b*) draw horizontal lines cutting $v\ a$ (Fig. 518*a*) in the points d_5 and 12, which will be another two points in the vertical projection of the curve. In Fig. 518 the edge is represented by $v_2\ a_2$, hence the intersections o and 12 of this line $v_2\ a_2$ with the verticals drawn through the points d_5 and 12 in Fig. 518*a* will give us another two points in the horizontal projection. Again, in Fig. 518*b* the points 16 and 13 lie in a cutting plane, which is represented by the vertical line drawn through $7d$; but the distance between this cutting plane and the edge $v_5\ a_5$ is equal to that between the same edge and the plane $1m\ 1b$, hence the intersection of the cutting through $7d$ will coincide, in Fig. 518*a*, with the line $1a\ 1p$, which is another view of the intersection of the cutting plane $1m\ 1b$ with the face $v_5\ a_5\ b_7$; therefore, through the points 16 and 13 (Fig. 518*b*), draw horizontal lines, cutting $1a\ 1p$ in the points 16 and 13, and through these points draw verticals, cutting the horizontal line through $7j$, in Fig. 518, in the points 16 and 13, and thus obtain two more points in the vertical and horizontal projection of the curve. Lastly, the distance between the cutting plane through $8d$ (Fig. 518*b*) and the edge $v_5\ a_5$, is equal to that between the same edge and the cutting plane $2\ m\ 2\ b$, and therefore the intersection of the cutting plane through $8d$ with the face $v_5\ d_7\ a_5$ will coincide with the line $2a\ 2p$, in Fig. 518*a*. But the cutting plane through $8d$ contains only one point of the curve, namely j_6; hence through this point draw a horizontal line cutting $2a\ 2p$ in the point h, and through this point draw a vertical line cutting $j_2\ k_2$ (Fig. 518) in the point 14; here we have found the vertical and horizontal projection of another point in the curve of intersection.

The distance between the points b_6 (Fig. 518) and v_2 must be equal to the horizontal distance between the point b_{11} and the line $v_5\ a_5$ (Fig. 518*b*); and the distance between the points b_4 and v_2 must be equal to the horizontal distance between b_9 and $v_5\ a_5$.

Joining all the points found in the foregoing manner by curved lines, we obtain the vertical and horizontal projection of the curve of intersection.

Howell Green.

Mr. Howell Green, of Easton, Pa., who for the past fourteen years has been superintendent of the Jeansville Iron Works, died on the 26th of October, of Bright's disease. Mr. Green was born in Phillipsburg, N. J., in 1830, and at the age of 17 was apprenticed to the machinists' trade. He rose to the positions of foreman and superintendent, and held various positions of responsibility connected with engineering pursuits, always satisfactorily and with credit to himself. He was popular with the men employed under him, and was always free to give full and satisfactory information to apprentices and others desiring it. He was a valued member of the American Society of Mechanical Engineers, a paper which he read before the society on the "History and Development of Winding and Pumping Machinery in the Authracite Regions," having attracted much attention and favorable comment. Socially, Mr. Green stood high in the community in which he lived, and was popular with all who knew him.

Engineering says of the works of Messrs. Platt at Oldham:

There are, it appears, over 8,000 hands employed at these immense works, a large proportion of which are skilled mechanics. The full employment of mill hands, which will result from the liberation of cotton, will encourage extended operations in other branches of trade, including the manufacture and erection of machinery in various parts of Lancashire.

Another apparently mysterious fire has taken place in China, in consequence of which all railroad building operations have been again stopped. This time the fire destroyed the "Altar of Heaven," which is regarded as one of the most sacred objects in the Celestial Kingdom, and it may, therefore, be some little time before the Emperor recovers from his fright sufficiently to let the construction proceed again.

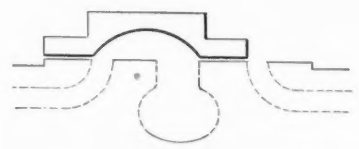
H. once told me how a party of Indians, fresh from the wilds, greeted their first view of a locomotive. They made no comment, and didn't even get up off the ground to examine it. But when a lineman walked up a telegraph pole, like a woodpecker up a maple, they fell into paroxysms of enthusiasm. Simply one thing was within the range of their astonishment, and the other wasn't. *Christian Union.*

The Modern Steam Plant and Its Management.

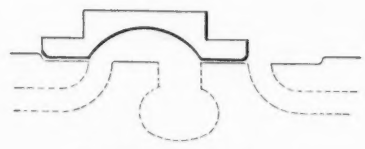
By Peter H. Bullock.

In order to change into mechanical motion the inert force of the steam we have generated in a boiler, it is necessary to employ suitable means at the engine to regulate and control the admission of it to the cylinder, and promptly effect its release when it has done its allotted work. To discuss the various apparatus employed for this purpose, and some of the things that are likely to happen to it, and the best methods of management, will be the subject of this paper. Of course no one person can be entirely familiar with all the styles of valve gear; and there are many kinds which the writer has had no experience in the care of, and what may be said of same is from a more or less close observation of their action in other plants than those I have been in charge of myself. Many styles have in themselves some peculiarity, and, perhaps, claimed superiority over all others, and the care of such will develop some special feature that will be essential in their case only, but there are many points in the care of valve gear that are common to all, and a knowledge of any one kind will be of value to a person in taking charge of any other kind.

The first thing encountered by the steam, after it passes the throttle, is the admission valves, and as the plain *D*, with a fixed travel, is the most common, we will talk of that first. In this class the motion over the seat is the same at all times, and the only variation under which it works is that of load upon it, or as the pressure in the chest is increased or decreased by the action of the throttle or throttling governor, as the case may be. Valves and seats working under these conditions should wear substantially even, and they will usually do so if dry steam is the rule, and not the exception; and if there is a regular supply of good oil at all times, instead of a deluge of poor at very infrequent intervals. If, however, the machine is frequently used as a water motor instead of a steam engine, and the oil is inappropriate in quality, and is injected at any time that suits the whim or convenience of the attendant, the life of the valve, or the time it will remain tight, will equal the unknown quantity. Why will the valve wear faster under these conditions? First, because the water washes off what oil there may be on it, or the seat, leaving both dry and ready for the least speck of dirt to commence an abrasion; besides, the water coming over mechanically from the boiler, brings with it the dirt and foreign matter which is kept near the surface by the rapid circulation, and it is brought over by the water and deposited on all parts of the chest, valve and seat, ready to commence its destructive cutting. This dirt does not leave the boiler with dry steam, and is only harmful in this direction when foaming or priming takes place. Another reason is the very sudden changes in the temperature of the parts that take place when steam and foaming water are alternately admitted into a steam chest. We will suppose that an engine is running under a chest pressure of 60 pounds, with its accompanying temperature of 307 degrees, and that all the parts have become heated to substantially the same point. Then if there comes along a lot of primed or entrained water it slightly cools and contracts the surface of all exposed parts, which are again heated and expanded the next instant by the dry steam that follows. Now these sudden and frequent changes have the effect of softening the surface of the iron, allowing it to more quickly wear away. Some kinds of oil seem to harden and polish valves and seats, while others penetrate the iron and make it soft and porous. Twenty-five years ago lard and tallow were universally used for cylinder lubrication, and it was common to find a steam chest so soft that a cold chisel could be driven into it half an inch at a single blow. There is no doubt that animal oil is the best for simply lubricating valve seats and cylinders at low or moderate pressures, but their disadvantages in other directions far outweigh this, and some of the prepared cylinder oils are far superior, all things considered. I remember an engineer who always kept a pot of tallow stewing on his steam chest, and who was very liberal in the amount he put inside. All the drips were collected into an iron tank under the engine room floor, and, as a natural consequence, that and the boiler became thoroughly greased. For removing the tallow from the tank and boiler, he was recommended to use soda or potash. Now this worthy did not believe in homeopathic doses, so he dissolved forty pounds of concentrated potash, and poured it into the tank late one afternoon. There was soon a tendency to foam, but he got along till stopping time. The place did not run for a few days after this, from the fact that when they were getting up steam the next morning there was an alarming increase in the heating surface of the boiler by its changing from a plain curved form into one more closely imitating nature—that is, oval in every direction. In this case the valve and seat were badly cut in the short time the engine foamed that memorable afternoon. The loss from boiler repairs was also quite heavy, but there might have been an entry on the other side of the account, giving credit for about fifty pounds of medium quality softsoap that was taken from the tank and boiler. As there are less dangerous and more appropriate methods for the manufacture of this useful detergent, it is not recommended to use any part of the steam apparatus for the purpose, but to keep the necessary ingredients—animal oil and alkalies—entirely separate.



Raised Seat



Flat Seat, corners worn

So much of the above as relates to the injurious effect of water and oil on valve seats applies equally to all kinds and styles in use, but there are other things that might injure one class while doing no harm to others.

The seats for slide valves should always be raised, that is, from the other surface of the chest, so that the valve should overlap at both ends of its travel; for if it moves on a plane surface it will make a slight depression, and the ends of it will become rounded, making it lift a little. If this wears it much it will also change the lead, making the admission sooner, inasmuch as is the difference between the rounded and a square corner. The accompanying sketch shows such wear, and the rounded parts enlarged.

In engines of the above class, where the regulating is done by throttling the admission of steam to the chest, the irregular wear is most liable to be on some part of the governor, which but slightly changes its position with each variation of speed. These parts become worn where they are in contact at the usual speed, and are often loose at such places, while they may bind or stick when in a position due to either a higher or lower speed. Quite often this will be the small stem that connects the governor valve, which will sometimes move so hard through the gland and stuffing-box as to allow the engine to get above the regular speed before it begins to act, and when it does start it will be with a jump that is dangerous to all connected parts. I have known of this movement being so sudden and severe that it broke the jointed arms and other parts of the governor. It will be found that there is less wear to the valve stem when it is packed with some soft, elastic material, stuffed with plumbago, and kept tight enough so that there is no leak of steam or water around it, for it will wear faster if there is leak from the

same causes as explained regarding valve seats.

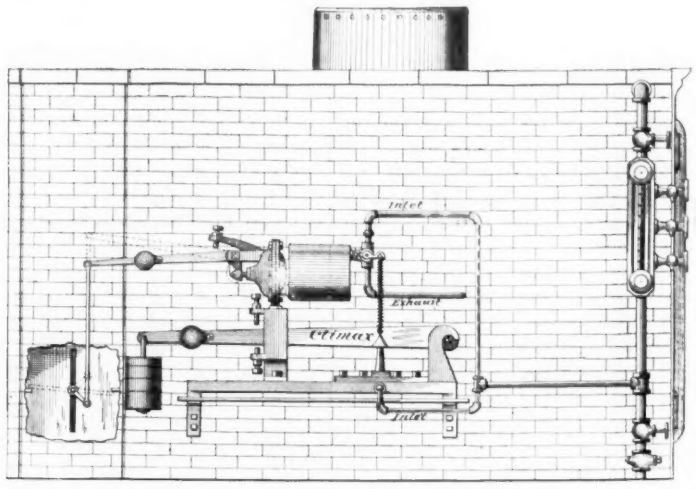
In types where the travel of the valve varies according to the load, the principal wear will come on to that part of the seat where the valve moves the most, or where the average load is. It often occurs that a valve may be quite tight at such places, while it will leak some at full travel. Little can be done to prevent this, but the use of a small and regular amount of good oil, and always having dry steam, will reduce such wear to the minimum.

The next class of valves are those known as the riding cut-off, or those where the main valve has a fixed travel, and the cut-off is effected by another valve riding on the former, and moved by an eccentric set so as to cut off the steam passing through the main valve at any point pre-determined. Where this is so the chest pressure is regulated by the governor, as with the plain *D* valve, but there are very good and well-regulated engines where the governing apparatus is attached by suitable connections to the riding valve, and its travel, and consequently the point of cut-off, is determined by the speed acting through such apparatus. In the first, the wear of the parts are more even, but the distribution of steam is far the best in the latter. In fact, some of the finer modifications of this style are in the front rank of economical engines of moderate power. In managing valve gear of this kind great care should be bestowed on the parts by which the travel of the valve is controlled; for rusty or gummed stems, cams or hooks will seriously impair the regulation, and the 1-16th of an inch in the travel of the valve makes a very material difference in the mean effective pressure of that particular stroke. This once or twice repeated jumps the speed, and with it the regulating apparatus, far above its normal position. This will be followed by two or more slow strokes, and then the thing will be repeated again, very much like the motion caused by unequal admission of steam, and described in the previous paper.

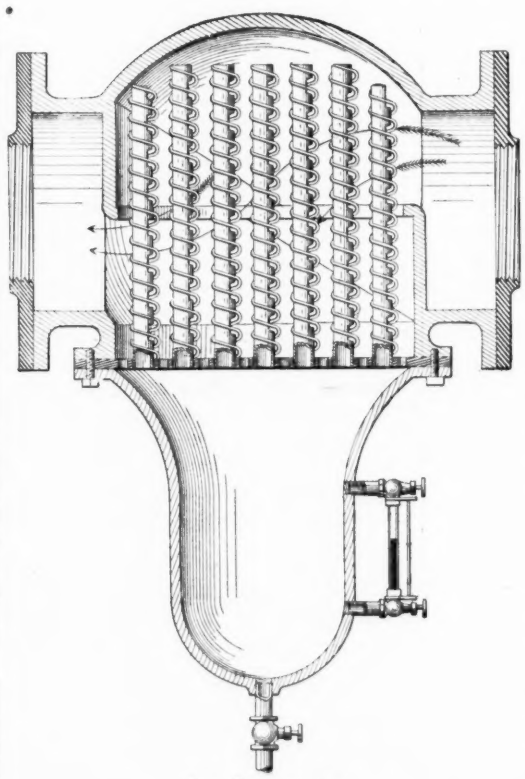
The next and most important are those known as the disengaging valve gear, of which the Corliss was the pioneer, and is the most common met with, both in its modified and so-called improved forms. In justice to some that have made alterations in the Corliss gear, it should be said that there is no need of the prefix "so-called," for the improvements are evident to any unbiased mind, and commend themselves by the accuracy of their operation.

The disengaging gear is so called from the fact that the valves are opened by a positive motion, which becomes detached from them at some point of the stroke determined by the position of the regulating apparatus, which in turn depends upon its position by the prearranged speed of the engine. The closing of valves of this class when disengaged is usually accomplished by means of weights, springs or dash-pots, and is more or less sharp and sudden, according to the theory or belief of the designers. In most kinds, however, there are means provided to limit the time the valve may stay open at any single stroke, so that in case the closing does not properly take place when the valve becomes detached, it will be forced to do so by a positive motion before the exhaust valve opens, thus preventing the steam blowing directly through the engine. In some forms the distance the valve opens determines the amount of steam admitted at that stroke, while in others the valve is fully opened at each stroke, and the amount of steam admitted is regulated by the time the valve remains open relative to the time occupied by that stroke. The former compare in the conditions under which they work, and are subject to the same unequal wear as slide valves with unequal travel, while those that open full and are regulated by the time the valve remains open, compare more nearly with slide valves of fixed travel.

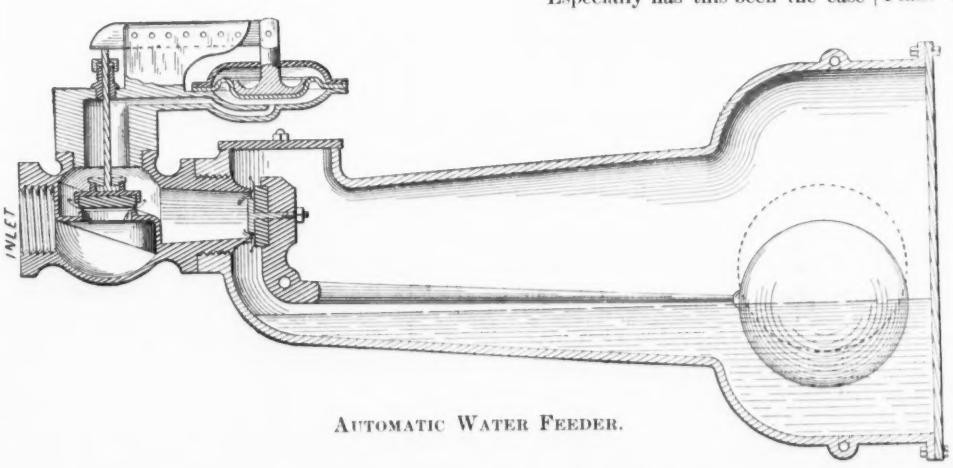
In nearly every style of disengaging gear there are hardened surfaces, across which some other part must move under considerable pressure until the time of cut-off arrives, when one passes by the other with more or less wear, according to the style of gear, and whether these parts drag by or have some clearance. There are several builders who make such parts flat and square, and held in place by screws in the center, thus making them reversible in every direction, and with eight surfaces that may be used in turn before the part has to be renewed. Such adaptations should be encouraged; for every simple device that enables an engineer to keep his engine at its best is not only an advantage to the owner and builders, but to utilize such means is also a credit to himself.



CLIMAX DAMPER REGULATOR.



OIL SEPARATOR.



AUTOMATIC WATER FEEDER.

Improved Boiler-Room Appliances.

The accompanying illustrations represent some new appliances for use about a steam plant, made by Timothy Kieley, of No. 11 West 13th street, New York city.

The damper regulator is attached to any convenient wall or other firm support, the cut showing it attached to the brick setting of the boiler. A pipe is led from below the water level of the water column, which is branched at the regulator, the lower branch supplying pressure to a diaphragm, which operates to raise the lower weighted lever, the upward movement of this lever operating to open a valve, which admits pressure from the upper branch to the upper diaphragm operating a smaller weighted lever, which in turn operates the damper. Both levers have adjustable weights upon them, by which the pressure at which they shall operate may be regulated. The exhaust can be run to any convenient place, sewer, drain-pipe or ash-pit. The upper lever can be connected to damper lever over pulleys, but it is preferable to connect direct to damper lever, as shown in the cut.

The construction of the oil separator is made plain by the illustration, and the course of the steam through it is indicated by the arrows. It contains a large number of vertical tubes, open at both ends, and surrounded by spiral coils of wire, the surfaces thus presented separating the entrained oil and water, and conducting them down to the receptacle below, which may be emptied at will, a glass gauge-glass indicating the height of the contents. This is intended for use on a horizontal pipe only, a modified form being made for a vertical pipe.

More or less trouble has been experienced with most water feeders used on house heating, and other boilers depending upon the pressure upon the street main to force the water into them. This has been due mainly to the valve in the water feeder becoming stopped up with dirt deposited by the water, which generally occurred during that part of the season in which the boiler was idle. Especially has this been the case where the pressure on the street main is very high, and where it was therefore necessary to have a water feeder with a very small valve, so as to enable the float to close it against the high pressure.

To overcome this difficulty has been the object sought in designing the pressure regulator and water feeder illustrated.

The area of the valve is equal to that of the pipe, which prevents all chance of becoming stopped up with dirt. To make it possible for the float to close so large a valve, it became necessary to bring about a reduction in the water pressure, and yet allow sufficient pressure to cause the water to enter the boiler. This is done automatically by the pressure regulator, through which the water must pass before it can enter the water feeder, thus holding back the excessive high pressure, so that the valve in the water feeder will have to close against a properly reduced pressure only.

The device is connected to the boiler in the ordinary way, and the water-pipe to the inlet, as indicated on the cut. The regulator should be set to give from 5 to 10 pounds more pressure than it is intended to carry on the boiler, and this is obtained by changing a fulcrum pin from one hole to another in the lever at the top.

LETTERS FROM PRACTICAL MEN.

The Metrical Problem.

Editor American Machinist:

I suggest as a contribution towards the solution of the metrical problem, that 40 inches be called the "American meter." Then, whenever any one wants to figure in decimals, he can divide result by .3, for feet, or multiply by 40 for inches in final result. If this were done, the decimal subdivisions would come into use as far as might be found practically convenient, while those who like the old units would not be interfered with. As the United States is likely to be the leading mechanical nation, other nations might use the new meter so far as they cared to come into unison with it.

The beauty of the decimal system mostly vanishes away whenever one begins to deal with squares and cubes. The "decimal point," while a splendid servant to the man of figures, is a stealthy and deadly enemy to the man who uses figures but a little; as well as to the newspaper reporter and the printer.

There is a necessity of the human mind, which requires popular units equivalent in size to the quantities usually dealt with.

The cubic yard is a very inconvenient unit for the engineer, but the contractor persists in using it because it represents to him just a wagon load. So a ton of coal, etc., etc. Let the pencil and paper men get these units worked into a decimal system, if they can; but the separate units the people will have; and their individuality must not be spoiled by constant reminder in the names that they belong to a system.

By all means let the lead-pencil man have the fun of chasing his beloved "decimal point" through all its burrows; give the poor mechanic liberty to use measures adapted to the work he is doing. J. P. N.

Round vs. Square Chimneys.

Editor American Machinist:

Prof. John E. Sweet, in his paper on "Steam Plant for Isolated Electric Lighting Purposes," in your last issue, says: "A round chimney flue is better than a square one." The above does not agree with my experience of over thirty years with chimney flues. Will Mr. Sweet explain why a round flue is superior to a square one?

WM. BARNET LE VAN.

A very good idea of the perfection to which the making of ships' chronometers has attained is gained by noting the performance of a chronometer which accompanied the ill-fated Polaris expedition, which set out in 1871, on an Arctic expedition. When Capt. Hall perished some time in 1872, the chronometer was abandoned, and lay buried in the snow for four winters, when it was found by some members of an English expedition, dug out and wound up, when it started up as usual, losing at a uniform rate of about one second per day. It had been subjected to temperatures ranging as low as 100° below zero. The chronometer was made in this city, and has been sent from the British admiralty office as a present to this country; being now in possession of the Navy Department.

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☞ Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

☞ We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

☞ We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

☞ Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

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NEW YORK, NOVEMBER 7, 1889.

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Business Activity.

It is usually expected that business will be good about this time of the year, if ever, and the present rush is to be attributed mostly, no doubt, to causes which are in operation every fall to a greater or less extent. But the crowded condition of the railroads at present, and the utter inability of many of them to handle the business offered them is significant, and there can now be very little doubt that a season of prosperity is before us. Prices of the materials entering into machine construction have risen, and there is an upward tendency in prices of machinery. Few manufacturers have for some time been willing to make any concessions, because they have been able to dispose of all they could make without concessions. This fact, taken in connection with the recent advances in materials, can of course have but one effect.

Railroad officials say that there is now a greater scarcity of freight cars than has ever been known before, many of the industries of Pittsburgh being seriously hampered by the lack of shipping facilities. It is reported that not over 70 per cent. of the coke which is being produced can be gotten away from the ovens, owing to the lack of cars to ship it in, and some furnaces are shutting down on account of having no fuel. Large orders have been and are being placed for rolling stock, the Pennsylvania having recently ordered 6,000 new freight cars and twenty-five locomotives from outside parties, aside from those produced in their own shops. So far we can see nothing to indicate an unhealthy condition or an unnatural activity, and we hope this will continue. We do not care to see too much of a boom, because the inevitable reaction must follow.

Jet Propulsion.

The man who proposes to drive vessels through the water at a speed rivaling that of the wind, by means of a small jet of water forced out of a tube at the stern at high-pressure, continues to get considerable advertising in the newspapers. Any one who proposes to upset physical and mechanical laws can do this, however; but a statement reported to have been made by him recently is not without interest of a certain kind. "With a pressure of 3,000 pounds to the square inch, through a three-quarter-inch nozzle, the Etruria could be driven twenty miles an hour." A three-quarter-inch nozzle has an area of .44 inch, and the pressure on an area of this size at 5,000 pounds per square inch would be 2,200 pounds. This, therefore, is all the force which could be realized theoretically in that way. Practically not near so much would be obtained, and thus the absurdity of the statement is at once apparent.

To quote further: "Dr. Jackson attributes the fact that the utility of the principle has never been thought out before, to the fact that it has hitherto always been considered by scientific men from the point of view of mechanics rather than of physics." Well, we shouldn't wonder if there is something in that. It won't do to look at most of these new schemes from a mechanical point of view, because that is usually fatal to the schemes.

Elevator Charges.

The decision of the Court of Appeals of New York in the elevator cases continues to attract considerable attention and comment, some complaint being heard of what is termed the practical confiscation of private property, resulting from the fixing by authority of the State of a maximum charge for elevating grain. It is claimed by those who take this view of the case, that there is no monopoly in the elevator business, because any one who chooses, and who has the necessary capital, can build an elevator and engage in the business of running it. At first blush this may seem to be true, but it is not really true, because an elevator must be situated in a certain place with regard to public lines of transportation; and the available space upon which elevators can be built and serve the purpose for which they are erected is often quite limited, and the few elevators occupying it are able to place such burdens upon the transportation of grain as seems best for their interests, without fear of competition. The authority of the State to regulate their charges seems to rest upon the fact that by and under the authority of the State they occupy a special location, giving them special privileges and enabling them to combine for the fixing of prices for what is an essential part of the operation of transferring grain from one part of the country to another. It is now generally admitted that the business of common carriers is subject to regulation by the State, and it is difficult to see by what principle these elevators, which are really an essential part of the carrying system, can be exempt from that authority. Of course we see the importance of caution in such legislation, and would regret to see injustice done; but it is to be remembered that if the laws are to represent the will of the people, monopolies of all kinds are to be more and more interfered with, for the people do not like them.

In this connection the words of Judge Andrews in rendering the decision are significant. He says: "There is a remedy at the polls, and it is an efficient remedy, if at the bottom the legislation under it is oppressive and unjust. The remedy, by taking away the power of the Legislature to act at all, would be radical and complete."

Information About the "Baltimore."

Some dispatches recently published simultaneously and in the same column of a New York daily paper, are interesting as going to show about how much dependence can be placed in news regarding the new vessels of the navy. One dispatch was from Washington, and said:

"If the cruiser Baltimore is finally given another trial, it will be after several very material changes in her machinery. In addition to altering the pitch of her screw, the Messrs. Cramp are changing the main cylinder valves, and are also trying to improve the exhaust of her low-pressure cylinders. They have not yet asked for a new trial, and will probably have another private trial first."

Immediately under this was a dispatch from Philadelphia, which said:

"Regarding the coming trial of the Baltimore, Mr. Cramp said: 'All the arrangements have been made for the trial between Secretary Tracy and myself, and it will probably take place in the course of a week. Just whom the trial board will consist of I don't know, but probably it will be the same as before. Coal and ballast have to be loaded, and work will commence at that to-morrow, and as soon as the trial board is reconvened we shall be ready for them."

The statements do not seem to consist exactly, but they come about as near it as any of the statements made on that subject. The people generally are, we believe, interested in and proud of the recent naval developments, but we think their feelings will undergo some change on the subject if they conclude that they are being trifled with, and they are liable to come to some such conclusion if contradictory and nonsensical dispatches continue to be served up to them, and all information which seems to bear any evidence of reliability is withheld. We think the policy which seems to have been adopted is a mistake, and that in the end it will prove itself to be so to the entire satisfaction of all concerned.

The ballot list of the American Society of Mechanical Engineers for the New York meeting, contains the names of fifty-one full members, two for promotion, three associates and twelve juniors. There are many excellent names on the list; in fact, the entire list is excellent. The growth of the association is healthy, not only as regards the numbers added, but as to the character of those who propose to add their names to the membership.

Literary Notes.

A THEORETICAL AND PRACTICAL TREATISE ON THE STRENGTH OF BEAMS AND COLUMNS, in which the ultimate and the elastic limit strength of beams and columns is computed from the ultimate and elastic limit, compressive and tensile strength of material, by means of formulas deduced from the correct and new theory of the transverse strength of materials. By Robert H. Cousins, Civil Engineer, formerly Assistant Professor of Mathematics at the Virginia Military Institute, Lexington, Va.

In this work the author advances a new theory and formulas, by which the strength of beams and columns can be computed from the direct crushing and tensile strength of the material, without the aid of the modulus of rupture, which, the author claims, has no place in nature. In regard to the neutral axis, he says: "Its position in a beam having a cross-section of a given shape at the instance of rupture, depends upon the material alone, or upon the ratio existing between the breaking compressive and tensile fiber strains. No line in this plane has any of the properties of an axis that are usually assigned to it by writers on this subject." The formulas proposed in this book are not simpler than those given by other writers, but the author believes that they will fully satisfy the results obtained by the experimenter. The book is well written and worthy of a careful perusal. It is published by E. & F. N. Spon, 12 Cortlandt street, New York. Price, $5.

PERSPECTIVE: A Series of Elementary Lectures by Ada Cone, Late Instructor in Massachusetts State Art Schools; Supervisor of Drawing in Concord, N. H., Public Schools, and Lecturer on Industrial Art to Teachers' Institutes; Pupil Museum of Fine Arts, Boston.

This excellent little book will undoubtedly be appreciated by all those who are about to take up the study of perspective drawing, and have either no time or no inclination to go into the details of the science, or to follow it to a far analysis. The work is very elementary in its character, the definitions are clearly given; that of vanishing points in particular is clearly stated. In fact, the subject, as far as it goes, is developed with great care, advancing gradually to the more difficult problems, giving a good explanation of the difficult parts of the subject encountered, thereby removing that which otherwise may be stumbling-blocks to beginners. In illustrating the subject no attempt has been made to show mere pictures, but the illustrations are outline perspective drawings of very simple objects, and subserve the text so as to make the explanation clearer. Of course, any one who is not familiar with geometrical drawing must not expect to learn this science without study and some hard work, but this little book will certainly be a great aid in the endeavor to conceive a clear conception of the elementary principles. The application of the principles to the drawing of flowers is very briefly given, yet sufficient is shown to make it interesting and instructive to flower painters. The book is published by W. T. Comstock, 23 Warren street, New York. Price, $1.00.

QUESTIONS AND ANSWERS

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(408) Reader, Peekskill, N. Y., asks: Did you ever publish, in your paper, any articles containing instructions for making blue prints? *A.*—Yes; see answer to Question 449, in our issue of Nov. 5, 1887.

(409) "A Reader," Brooklyn, writes: Please give the most simple rule you know of to figure gears for cutting threads on a lathe. *A.*—We have already done that in this volume. You will find it in the issue of February 14, Question No. 70.

(410) W. E. P., Brooklyn, N. Y., writes: Please explain to me how the rifle bore is cut in a gun barrel. *A.*—It is done on rifling machines,

which we cannot well describe here. The cutting tool is at the end of a bar or rod, which is drawn through the barrel and at the same time rotated.

(411) "Speed," Chicago, Ill., asks: Will you give the proper speed in feet per minute of a planer or shaper for cast-iron? Also for lathe or boring mill. *A.*—There is no proper speed which applies to all cases. 20 feet per minute is about the average, but this is varied widely either way according to circumstances.

(412) C. A., High Bridge, N. J., asks: To what part of an ordinary marine beam engine, such as are used on ferryboats, is the vacuum gauge connected? *A.*—The vacuum gauge is sometimes connected to the condenser and sometimes to the exhaust side pipe. The nearer that the connection is made to the cylinder, the closer will be the record of the gauge.

(413) A. B. C., Altoona, Pa., asks: Will you kindly advise me what books I should get for the purpose of studying up the subject of lathe gearing, and the calculations necessary thereto; also giving the formulæ necessary for laying off gears for working drawings, etc.? *A.*—You can get information concerning such books by consulting the catalogues of publishers of scientific and technical books.

(414) G. M. T., ———, writes: A man is cutting a keyway in a crank on a slotting machine; he claims that, by setting the crank so that the corners of a square-nose tool touch the bore of the crank at the two sides of the keyway as it is laid off, that the keyway will be true whether the face of the tool is at right angles to the line of feed screw or not. I say that the sides of keyway will not be square with the bottom if the tool is ground so that the cutting face is not square with feed screw and the job is set in the way he says. Which is right? *A.*—You are right.

(415) O. N. T., Hartford, Conn., asks: Will you please tell me how I can ascertain the correct diameter to turn a worm gear blank to run with a worm, the outside diameter of which is two inches, pitch of screw three threads per inch? Worm gear has 66 teeth. *A.*—The linear pitch of the worm is ⅛ inch, or .333 inch, and the circumference of the wheel at the pitch line will be equal to .333 × 66 = 21.98 inches. The pitch diameter will be 21.98 ÷ 3.1416 = practically 7 inches. The total outside diameter will depend upon the form adopted, and is best determined from a sketch.

(416) A. G. C., East Dubuque, Ill., asks: Have you stated in former issues what should be observed in drawings to have them reproduced by printing, and get the best results? *A.*—We understand you ask for a description of the blue printing process. This you will find in answer to Question 449, in our issue of November 5, 1887. 2. Are there any stamps with which the letters can be stamped on a drawing? *A.*—There are rubber stamps made for printing moderate sized titles on paper, but the general practice is to write or print by hand the titles, letters, etc., on the drawings, and India ink is used for that purpose.

(417) J. G., Savannah, Ga, writes: Please give me the greatest height through which water can be drawn vertically with a suction pump without the aid of any valves in the suction pipe. *A.*—Taking the atmospheric pressure at 14.7 pounds per square inch, and the weight of fresh water at .036 per cubic inch, we have 14.7 ÷ .036 = 408.33 inches, or say 34 feet, which is the greatest height of a column of water the air pressure can sustain. Therefore a suction pump cannot possibly raise fresh water through a greater vertical distance than 34 feet, provided there is no air pressure on top of the column. But in a suction pump the column is raised against a little air pressure, because we cannot obtain a perfect vacuum in the suction pipe; therefore we may say that a suction pump cannot raise water through a vertical distance greater than 28 or 30 feet.

(418) "Trenton," Trenton, N. J, asks: 1. Is there a solution in which I can dip polished tools to keep them from rusting? *A.*—The best thing we know of is to coat them with vaseline. 2. Will you please give me the simplest rules you know for getting the depth and width of gear teeth? *A.*—There is no fixed rule for width. The depth is equal to 2 divided by the diametral pitch, plus the clearance. For instance, a tooth of 10 pitch will be ⅖ deep plus the clearance, which may be .1 the thickness of the tooth. A 10-pitch tooth is .157″ thick, and the clearance is accordingly .016″, and the total depth .216″. The clamp you speak of can easily be made rapidly at one operation, but you will need a machine for the purpose. If you cannot design such a machine, address the builders of special machinery, telling them just what you want to do.

(419) R. W. B., Philadelphia, Pa., asks: What pressure will a 5″x6″ vertical engine exert running at 350 revolutions, boiler pressure 80 pounds? The reason I want this information is to enable me to calculate the size of the girder on which the engine is to stand. The engine is now on the third floor of the back building, and causes the floor to vibrate. I want to overcome this difficulty. *A.*—The vibration of the floor may be due, to a great extent, to the imperfect balancing of the moving parts of the engine; if so, it should be corrected. To find the dimensions of the girder you will only need to take into the account the weight of the engine, and such other loads to which the girder may be subjected, and take a factor of safety, say 8, to allow for the slight vibration due to the working of the engine. The formula for determining the dimensions of the girder will depend on the material of which it is to be made, also on the position of the engine; that is to say, whether the engine is placed on the center of the girder or not; of this you say nothing; hence we must refer you to any good engineer's pocket book, in which you will find formulas suitable for the different conditions. Probably the best way will be to call in a good engineer, and let him make the necessary calculations.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Prestoline & Prestoline Paste, for cleaning & polishing metals. S. A. Smith, 23 S. Canal st., Chicago.

Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Iron Planers from 16″ to 36″ wide by any length. H. C. Pease & Co., Worcester, Mass.

Patent Attorney. R. G. DuBois, 715 11th st., Wash., D. C., procures first-class patents for inventors.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

The hook on steam engines is being supplanted by the Dill disconnecting device made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Oct. 24, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

The "Handy," "Smith," "Diamond" and "Favorite" Screw Plates are manufactured by S. W. Card & Co., Mansfield, Mass.

25″, 28″, 32″, 36″ Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

Eureka Cotton Machine Belting; a cheap and perfect substitute for leather or rubber belting. Address Eureka Fire Hose Company, 13 Barclay st., New York, for prices and samples.

25″, 32″, 37″, 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages. Illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

Barnard's Separator, for Separating and Removing Entrained Water from Live Steam, and Condense Water, Oil, Dirt, etc., from Exhaust Steam. Special Design for Surface Condensers. Send for circular and prices. Geo. A. Barnard, 15 Cortlandt st., New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patents, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't Delamater Iron Works, will hereafter manufacture the Delamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the Delamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Patterson, Gottfried & Hunter (Lim.), 146-150 Centre st., N. Y., carry a complete stock of Brush, Copper, Celluvert Fiber, Oiled Paper, Hard Rubber, Rod & Sheet Brass, Brass, Copper & Iron Wire, Self-Hardening Tool Steel, Set & Cap Screws, Machine Bolts, Machine & Wood Screws, Taps & Dies, Flies and Twist Drills, Blowers & Forges, Machinery, Tools & Hardware, Gear Wheels, Wood Pulleys, Shafting, Hangers & Belting. General factory supplies.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 101 articles have thus far appeared up to and including the October 3, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including October 10, 1889 issue, 87 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

C. H. De Lamater & Co. have closed their extensive manufactory at the foot of West 13th street, New York, and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale a very desirable lot of machinery, such as lathes from 15′ to 88″ swing, planing machines 48″x45″x10′, 53″x50″x12′, 17″x14″x24′, 72″x69″x24′, and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel; also steam hammers, and two 8″x16″ and one 10″x20″ Rider cut-off engines.

MANUFACTURES

Work has begun on the railroad shops at Cloverport, Ky.

Charles Hewitt & Co. will build a shoe manufactory at Taunton, Mass.

The Rowe Heater Company has been incorporated at Chicago, Ill.

The American Mill Co., Nashville, Tenn., will largely increase their facilities.

M. E. Graves has secured the contract for furnishing 170 arc lights at Oswego, N. Y.

An electric light company has been organized at Griffin, Ga. H. E. Burr is president.

Joseph Herbert will materially enlarge his sash and blind factory at Northampton, Mass.

The Standard Manufacturing Co., Mt. Carmel, Ill., has been chartered, to manufacture machinery. Capital, $100,000.

The Indianapolis Planing Mill Co., of Indianapolis, Ind., has been incorporated, with an authorized capital of $10,000.

The Decatur, Chesapeake & New Orleans Railroad Co., whose road is now under construction, will locate its machine shops at New Decatur, Ala.

Howe, Brown & Co., Limited, steel manufacturers at Pittsburgh, Pa., it is stated, will increase their capacity by the erection of a 20-ton open-hearth furnace.

The Northern Belle Mining Co. has been incorporated at Hot Springs, Ark., by John Gasson, A. C. Jones, R. L. Baker and others. The authorized capital stock is $5,000,000. Mr. Gasson is president.

A continuous spinning machine, just completed, is on exhibition at the works of the McLagon Foundry Co., New Haven, Conn. It is said to be entirely novel, and to solve the problem of continuous wool spinning.

It is reported that the foundry and engine works of John Bass, at Fort Wayne, St. Louis and Chicago, and his iron mines in Alabama, are about to be transferred to an English syndicate, at a figure thought to be near $3,000,000.

A catalogue issued by the Moore Manufacturing & Foundry Co., of Milwaukee, Wis., gives descriptions and illustrations of their car door hangers, novelty tackle blocks, differential pulley blocks, hardware, specialties, etc.

The Batcheller boot and shoe factory at North Brookfield, Mass., has started under the name of The E. & A. H. Batcheller Company. The company is organized under the laws of Massachusetts. Francis Batcheller is president, and Robert Batcheller is treasurer.

The Patton Hollowware Manufacturing Works, the forge shops of the Columbus Bolt Works, and Harker & Henderson's Elbow and Specialty Goods Works at Columbus, Ohio, were almost totally destroyed by fire recently. Fire caught from one of the boilers.

The contract for the mason work for the new building for Cluett, Coon & Co., at Albany, N. Y., has been awarded and work begun. The building will be 100x100 feet and five stories high, with a basement. It will cost about $80,000, and will be occupied as a collar and shirt factory by the new firm, who expect to move in next April.

H. O. Canfield, Bridgeport, Conn., is putting on he market a full line of rubber gaskets. He claims to make a rubber gasket for steam that will remain intact at a temperature of nearly 400 degrees. He also makes a special gasket for water line glasses, and special gaskets for other purposes.

The firm of Krupp, Essen, Germany, has been given an order for 10,000 tons steel rails for the Tehuantepec Railway in Mexico. Another Mexican railway company is negotiating in Germany for the whole iron and steel material required for the building of the line from Minatitlan to Salina Cruz.

The Birmingham (Ala.) Gas, Electric Light and Power Co. has been incorporated by J. F. B. Jackson, G. L. Morris, J. T. Johnston and W. A. Walker, Jr. It has purchased the property of the Birmingham Gas Co., and will, it is said, make extensive improvements. The capital stock is $500,000.

The L. W. Pond Machine Co., Worcester, Mass., write us: We have moved into our new shops, and are in shape to increase our production largely. We are having our share of orders, and find inquiries are increasing very rapidly, and feel that the outlook for a good season's business is very favorable.

The car wheel works at New Decatur, Ala., are turning out 60 car wheels daily. They have entered into a contract with the Louisville & Nashville Railway to supply that road with all wheels needed on the system south of Nashville, Tenn., and are also supplying the United States Rolling Stock Company with wheels.

The increase in the price of steel this month has caused the announcement of an advance in wages at the Pennsylvania Steel Works, at Steelton, to take effect on the 1st of November. The increase will not be uniform, but will range from five to ten per cent. This is the second increase within three months. The works are crowded with orders, and running full force in all the departments.

J. A. Barnes, Oshkosh, Wis., manufacturer of saw-mill and planing mill machinery, is building a new machine shop, 40x90, and stocking it with the latest improved machinery; he is also building a new foundry, 30x90. These new buildings are the result of a constantly increasing demand for his specialties, viz., the Miller patent saw sharpener, the Barnes slasher or cut-off saw, and his patent panel sander.

Eastern and Pittsburgh capitalists are about to inaugurate a great glass enterprise near Pittsburgh, Pa. The invested capital will be $3,500,000. On a tract of 500 acres, embracing one and one-half miles of river front in the Monongahela Fourth pool, there will be erected, among other factories, plate-glass works 1,500 feet long, and employing at the outside nearly 3,000 men. The purchase price of the tract was $250,000, and the options were closed and deposits made last week.

The Detroit Dry Dock Company has closed a contract with the Interocean Transportation Company, of Chicago, for the construction of one of the largest steel steamships on the lakes. It will be arranged to carry from 800 to 1,000 tons of water ballast, and will be able to enter Chicago harbor with a cargo of over 3,000 gross tons. They will pay $250,000 for the ship, and will use it chiefly in the transportation of iron ore from Escanaba to Chicago. It will be ready for next season's business.

The Mason Regulator Co. are occupying their new shops at Milton, Mass. These shops are 34x80 feet, two stories high, and arranged to give the maximum of light. The shops were designed by Mr. Mason, and are specially fitted up for manufacturing the specialties made by the company, such as pressure regulators, damper regulators, reducing valves, etc. We are informed that the company, just at present, have a boom on reducing valves for car heaters; for this purpose they have designed a special valve, which seems to be very successful.

A party of Akron capitalists have purchased the Canton (Ohio) Street Railway Company and the Lake Side Railway Company lines, for $150,000, and will change the present horse cars for electric motor cars, and build additional lines in the city. It has been decided to spend $125,000 in improvements and new lines. At present the Street Railway Company operates two lines, each three miles long, and the Lake Side Railway Company operates a road connecting with street lines in the suburbs, and running out to Myers Lake, a noted summer resort, two and a half miles from the city. The new company will build about four miles of new road early in the spring.

The Akron (Ohio) *Beacon* says: "The Star Tool Manufacturing Co. is making arrangements to put up a mammoth building just north of the Reed & Rattan building. It will be a brick and frame structure. The brick part will be 180x48 feet. The frame part will be at the east end of the brick, and although the plan for this part has not been adopted, it was stated that it would be 300 feet in length. The stone work for the brick section is nearly completed, and a large force of men is engaged in blasting and grading the ground for the frame part, which is an indication that the work on this building will be pushed to completion as rapidly as possible, and when finished will be 480 feet in length."

The *Iron Trade Review* says: "The Gobeille Pattern Co. has been organized, to carry on the business of the Gobeille Pattern Works, Cleveland, Ohio, heretofore under the sole ownership and management of Mr. Joseph Leon Gobeille, probably the most expert pattern manufacturer in the country. The new company has a capital stock of $40,000, all subscribed, and starts out under the most favorable auspices. The officers are: President, S. T. Wellman, late of the Otis Iron and Steel Co., now consulting engineer of the Illinois Steel Co., and vice-president of the American Wire Co.; vice-president, E. G. Powell, capitalist; general manager and treasurer, Joseph Leon Gobeille; secretary, George W. Kohlmetz. The other directors are: W. R. Warner, of Warner & Swasey, and A. T. Perry, president of the Forest City Chemical Co.

Machinists' Supplies and Iron.

NEW YORK, Nov. 2, 1889.

Considerable scarcity is complained of in some lines, and the product of many furnaces is contracted well into 1890. We quote Northern brands, No. 1 X Foundry, $17.50 to $18.50; No. 2, $16.50 to $17.50 Southern brands, No. 1, $17.25 to $18; No. 2, $16.50 to $17. Northern brands, Grey Forge, $15.50 to $16. Southern brands, $15.50 to $16.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Foundry foreman, 17 years' exp., desires position. General machinery preferred. Box 37, AM. MACH.

Competent agents wanted to represent a meritorious & paying steam specialty. Business, AM. MACH.

Mechanical draftsman and designer wanted. Address Box 42, AMERICAN MACHINIST.

Wanted—Position by a competent and experienced mech. draftsman. Address Box 43, AM. MACHINIST.

Position wanted as superintendent by one familiar with first-class engine work—Corliss specialty—and heavy machinery. C. H. T., AMERICAN MACHINIST.

Foreman and contractor wanted, who can handle men and do good work promptly. Address Steam Engine, care AMERICAN MACHINIST.

Wanted—Three competent blacksmiths accustomed to heavy machinery, locomotive or marine work. Rich. Loco. & Mach. Works, Richmond, Va.

A thoroughly trained electrical engineer desires position with firm mfg. electrical mach'y, or contemplating such work. Well posted on economical production and mech. requirements. Power, AM. MACH.

Wanted—A foreman to take charge of the tool and repair shop of a works forging and finishing goods in iron and steel. Address, stating age and experience, A. Y., AMERICAN MACHINIST.

Machinists Wanted—Vise hands accustomed to first-class work. Steady employm't and liberal wages guaranteed. Have largely increased our plant and need more men. Niles Tool Works, Hamilton, O.

Expert mech. and draftsman, holding position as ass't sup't, is open to engagement. Line: lighter machinery and tools, also arrangement of equipment in factories. Address "Shop Practice," AM. MACH.

Wanted—Practical foreman to sup'd dep't in the erecting of small tools, lathes, drill presses, turret lathes, milling machines, etc.; must be competent in handling men. Address with ref's, A. B., AM. MACH.

An energetic young man with 8 years' exp. as a mach., 3 years at a first-class tech. school. Special study given to drafting and designing machinery, with a good knowledge of blacksmithing and pattern making, wishes to correspond with parties in need of such a man Address "Energy," AM. MACH

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

20" Lever Drill Presses, $65. S. M. York, Clevel'd, O.

Koopman's Scales for quick measurements.

Glass Triangles. F. E. Harthan, Worcester, Mass.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, O.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

D. J. Kelsey, M. E., Designer of Automatic Machinery, 31 Insurance Building, New Haven, Conn.

Wanted—Two engine lathes, about 16 inch swing. One upright drill, about 20 inch. Second-hand. J. W. M. Barton, Vt.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

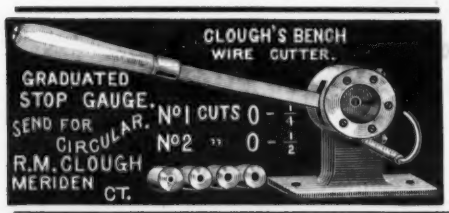
Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Maslin's Patent Pulsator Pump.

PAT. FEB. 12, 1889.

Cheapest and Best Automatic Steam Vacuum Pump. Handling DIRTY and GRITTY LIQUIDS without Wear, Oil or Care. Simple, Economical, Efficient & Durable. Pumping Plants for Contractors, Irrigation, Water Works, Railroads, Mining & General Hydraulic Purposes. Write or call for Circulars. JOHN MASLIN & SON, SOLE MANUF'RS, 165-167 1st St., Jersey City, N. J.



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The BEST in the WORLD

RUN BY BELT.

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Over 1500 in USE

BRADLEY'S UPRIGHT HAMMER.

BRADLEY'S HEATING FORGES

BRADLEY'S HARD COAL HEATING FORGE.

Indispensable in all shops to keep BRADLEY'S CUSHIONED HAMMERS and men fully employed and reduce the cost of production.

BRADLEY'S SOFT COAL FORGE.

BRADLEY & CO. SYRACUSE, N.Y.
12 Murray st. NEW YORK; 98 Sudbury st. BOSTON, MASS

A TREATISE ON STEAM BOILERS.

Their Strength, Construction and Economical Working. By Robert Wilson, C. E. Enlarged from the 5th English edition by J. J. Flather, Ph. D., with the addition of numerous fine illustrations. 12mo. cloth $2.50

JOHN WILEY & SONS, NEW YORK

Prepaid by Mail on the receipt of the price.

PECK'S PAT. DROP PRESS.
BEECHER & PECK, NEW HAVEN CONN.

DROP FORGINGS OF IRON OR STEEL
BEECHER & PECK, NEW HAVEN CONN.

WILLIAM JESSOP & SONS, L'D.

MANUFACTORY, SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.

JESSOP'S BEST TOOL STEEL

Cold Medal, Paris, 1889.

Importation Orders Promptly filled.

ALL KINDS OF Steel in Stock.

"Star" Foot Lathe Swings 9x25 in.

LATHE

Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers.

LATHE

Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co., 687 Water St., Seneca Falls, N. Y.

Send your name and address at once to

MONTGOMERY & CO.,

105 FULTON ST., NEW YORK,

and have them mail you a copy of their Novelty Pamphlet No. 2, which will be ready about Oct. 10, 1889. Every Machinist in the country should see it.

WELDLESS STEEL QUICK OPENING GATE VALVE. COLD DRAWN TUBES

SMOOTH INSIDE & OUT.

JOHN S. LENG, 4 Fletcher St. N.Y.

TO BUYERS AND USERS OF MACHINERY.

You will save money and get what you pay for by having us examine machinery and report on the same before buying. Try us and be convinced.

We also make drawings and blue prints, and give SPECIAL ATTENTION TO THE DESIGNING OF MACHINERY FOR ALL PURPOSES. Send for Blue Book giving more information.

JONES & MACK,

MECHANICAL ENGINEERS,

5 W. 4th Street, Cincinnati, O.

PATENTS!

WRITE AT ONCE FOR ILLUSTRATED CIRCULAR and INSTRUCTIONS.

ADVICE FREE.

J. B. CRALLE & CO., WASHINGTON, D. C.

GEO. F. BLAKE MANF'G CO.

BUILDERS OF EVERY VARIETY OF

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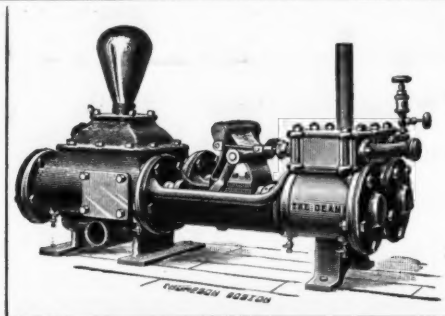

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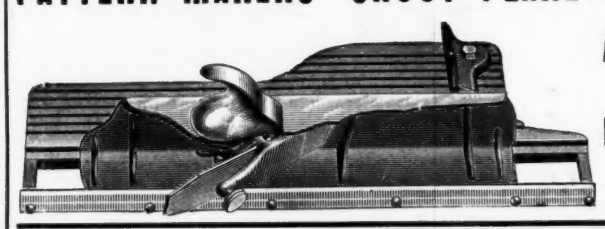

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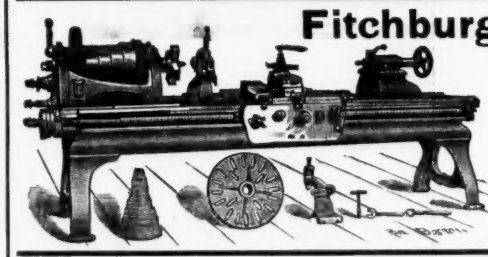

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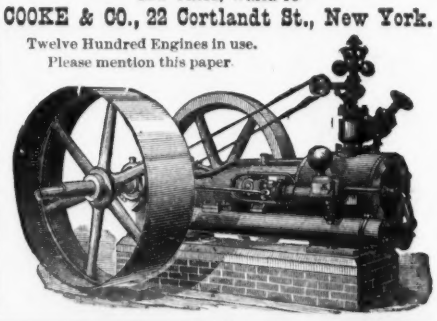

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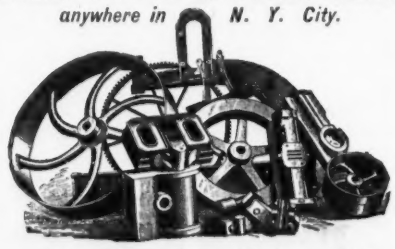

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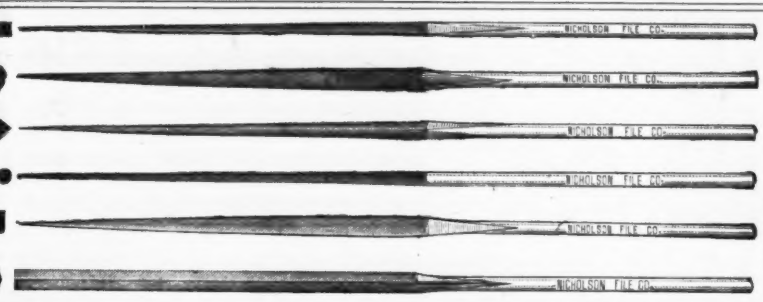

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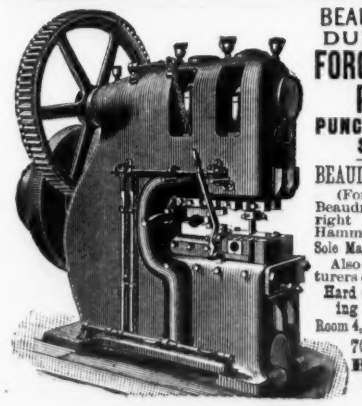

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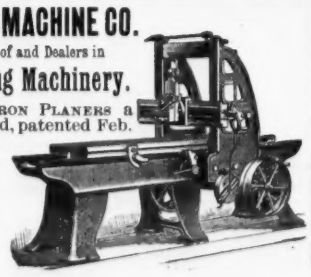

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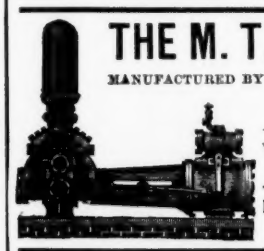

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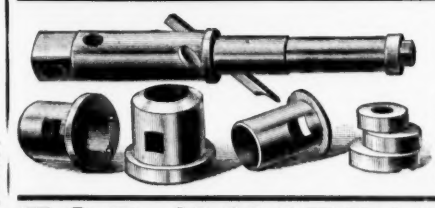

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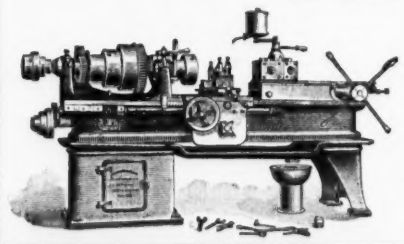

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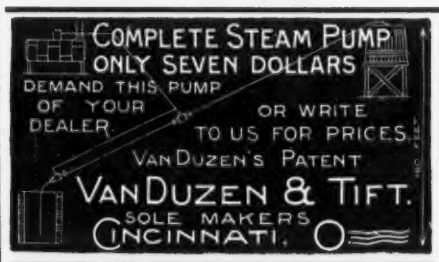

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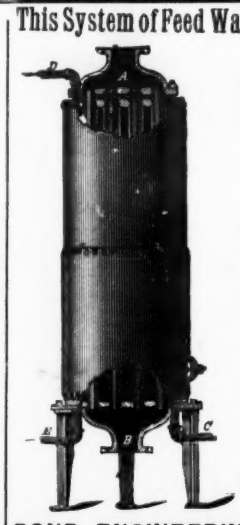

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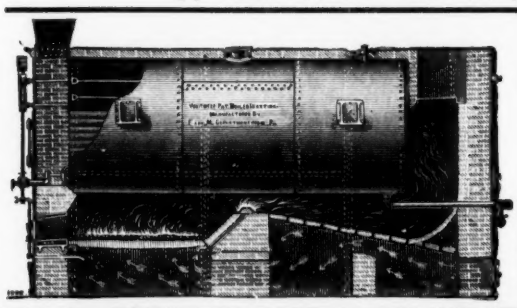

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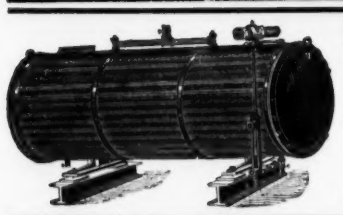

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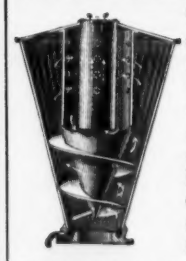

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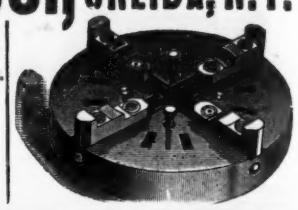

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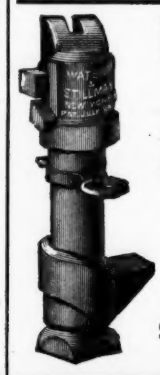

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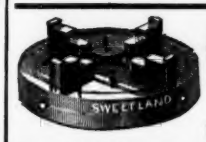

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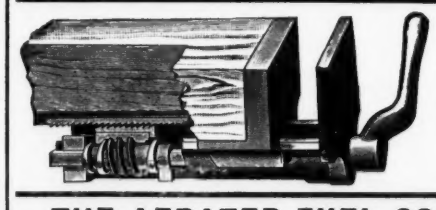

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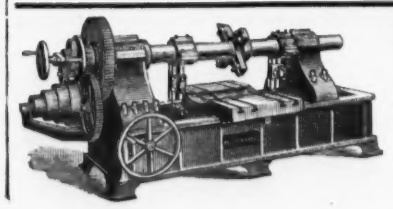

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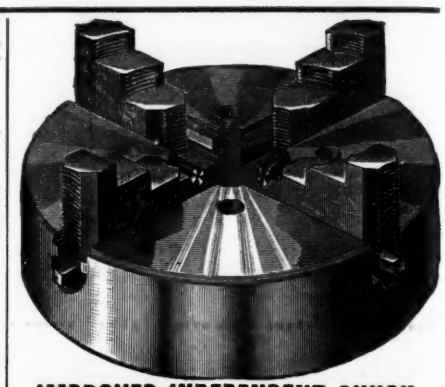

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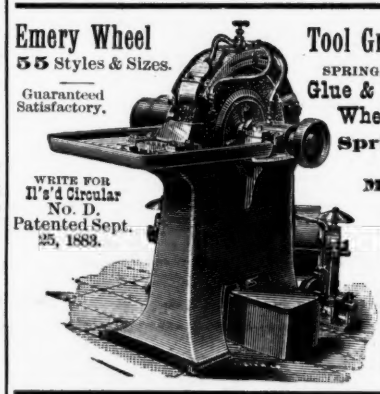

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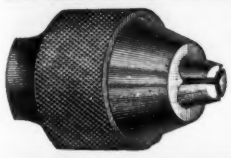

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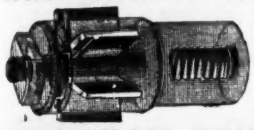

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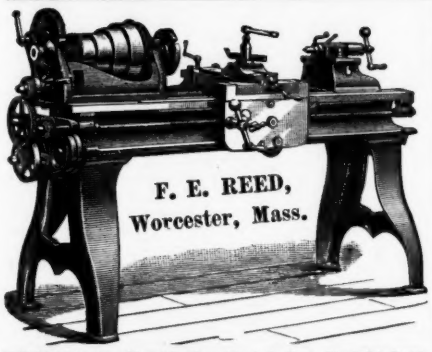

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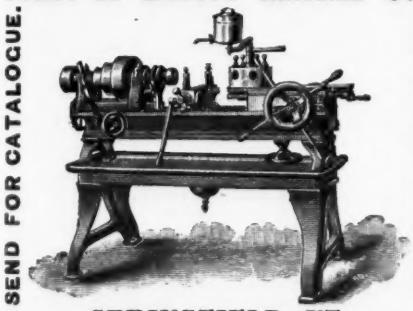

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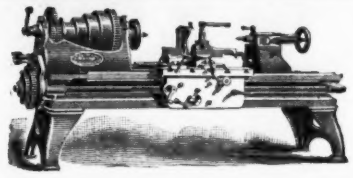

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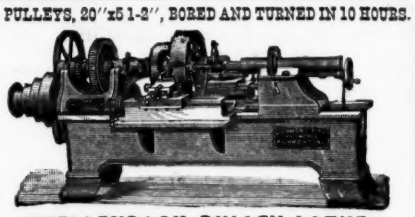

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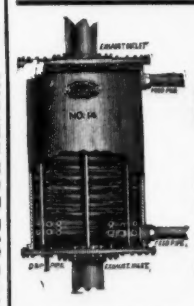

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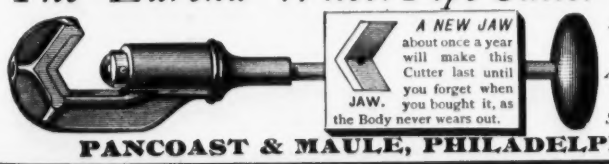

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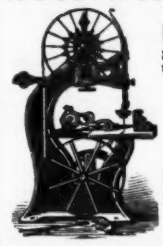

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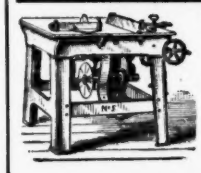

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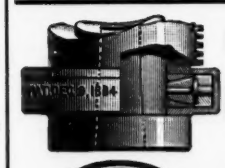

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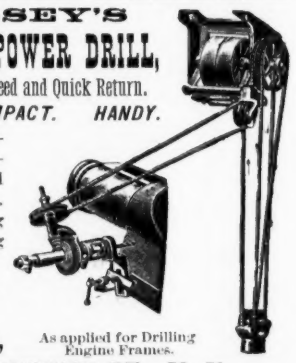

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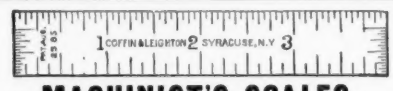

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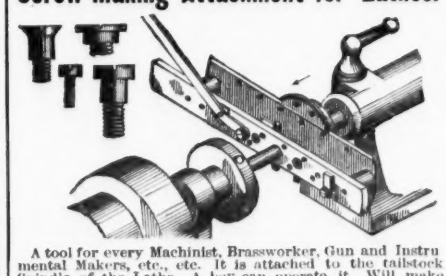

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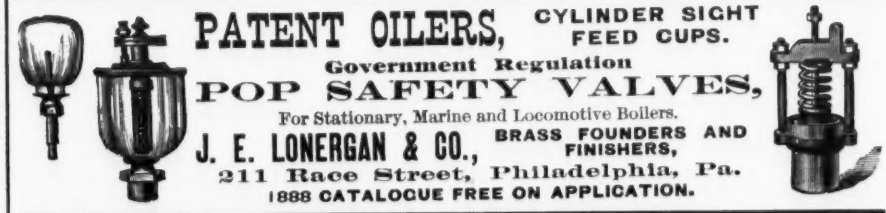

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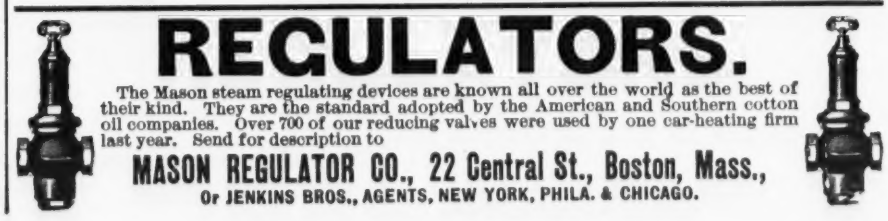

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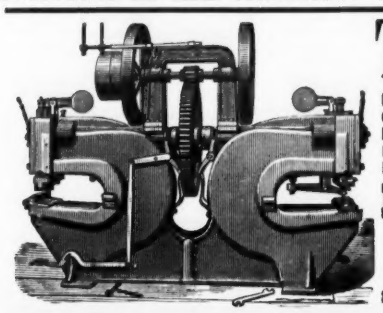

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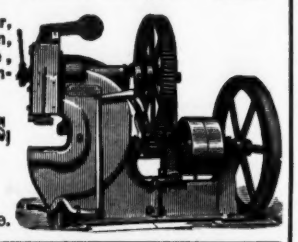

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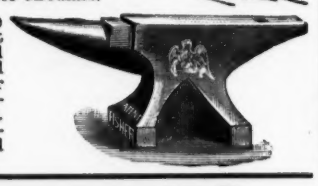

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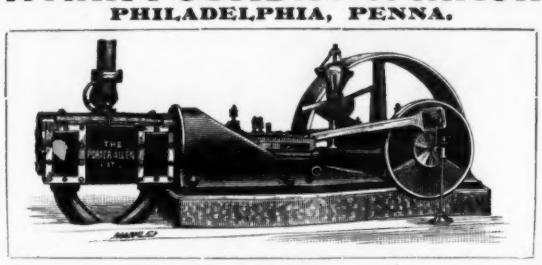

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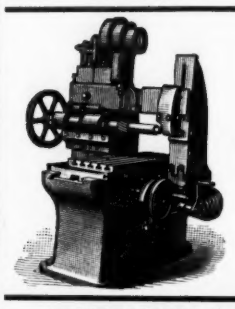

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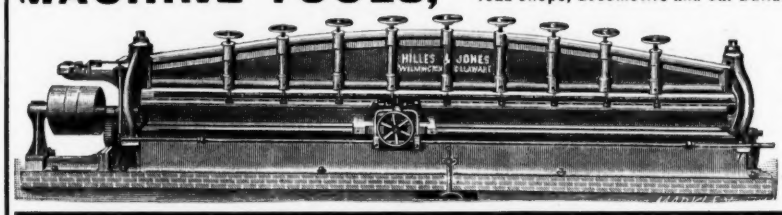

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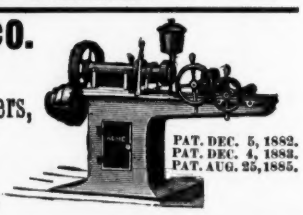

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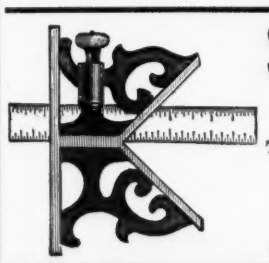

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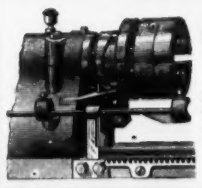

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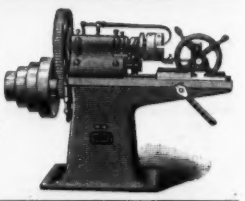

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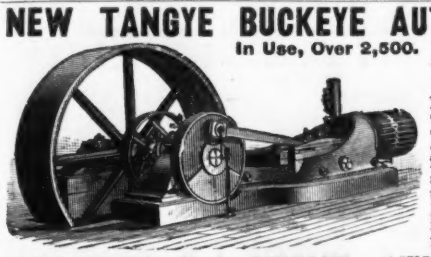

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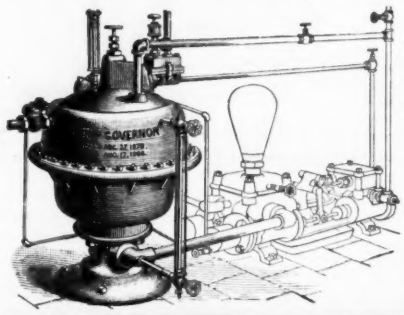

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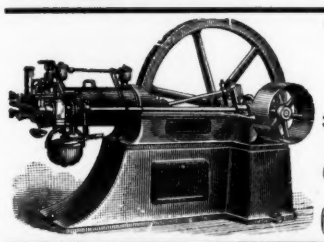

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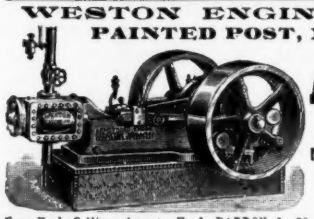

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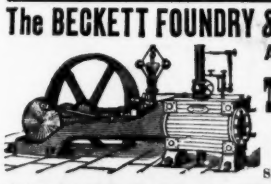

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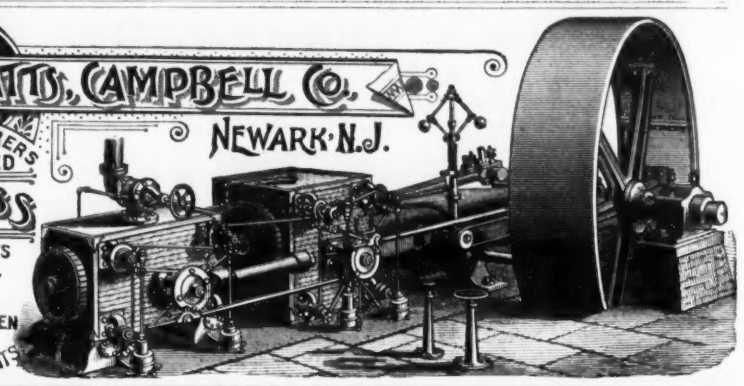

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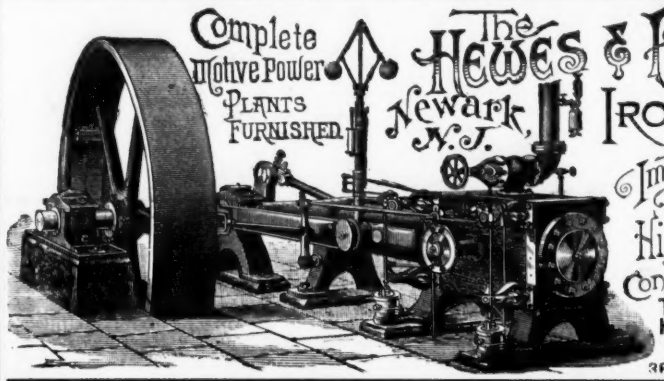

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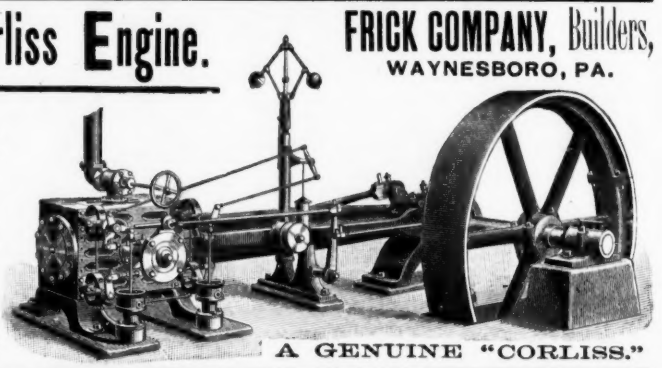

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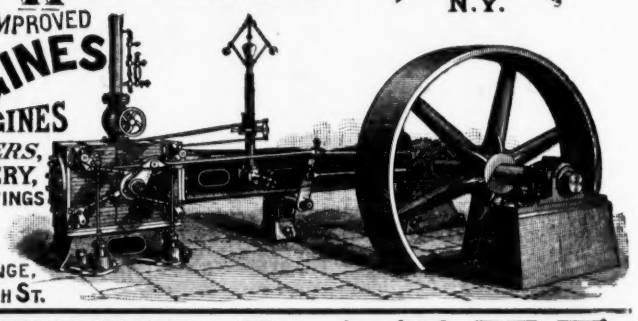

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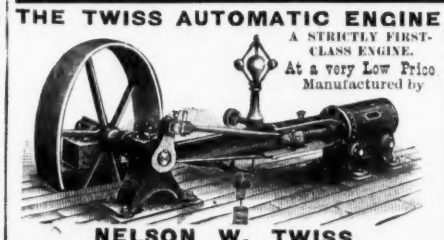

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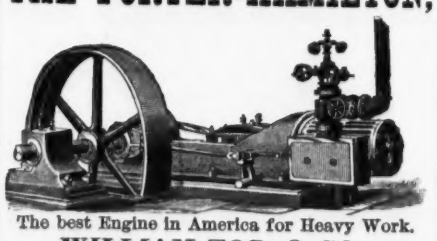

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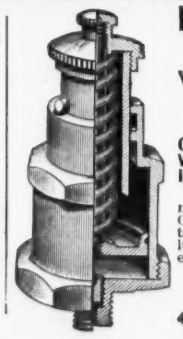

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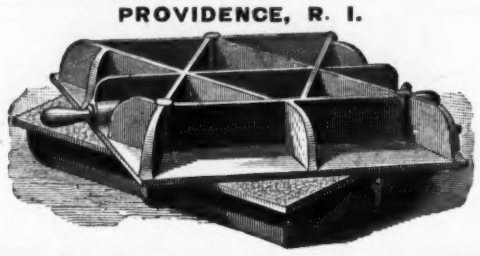

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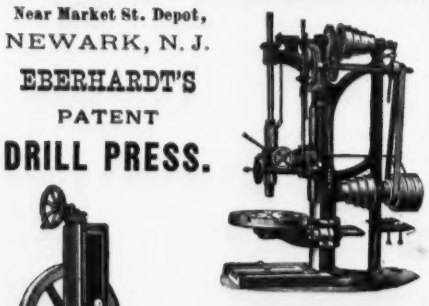

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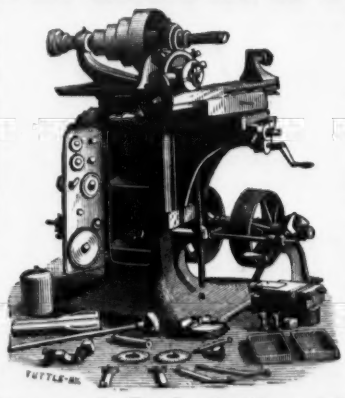

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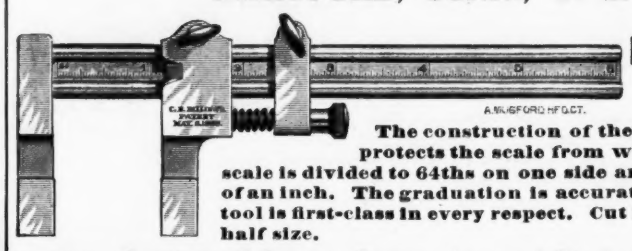

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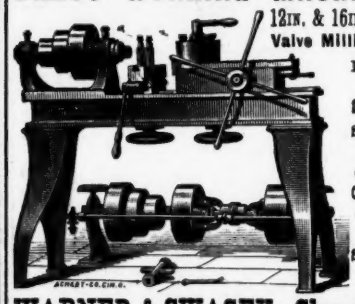

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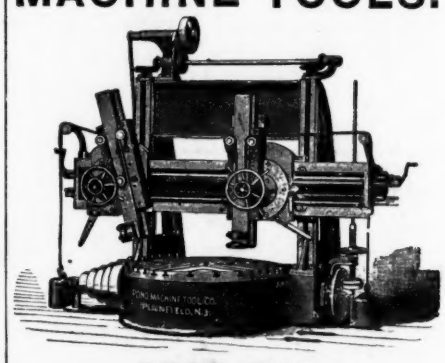

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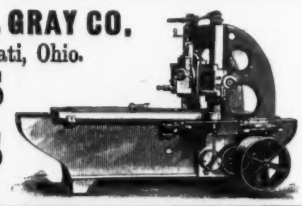

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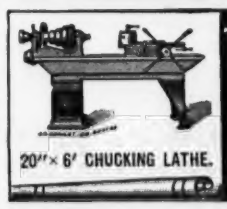

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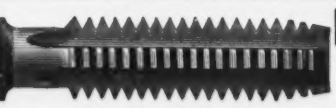

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